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SUPERSEDING
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DEPARTMENT OF DEFENSE
INTERFACE STANDARD

INTEROPERABILITY STANDARD FOR
25-KHZ TDMA/DAMA TERMINAL WAVEFORM
(Including 5- and 25-kHz Slave Channels)

AMSC N/A AREA TCSS

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

FOREWORD

1. This standard is approved for use by all Departments and Agencies of the Department of Defense (DoD).

2. In accordance with DoD Instruction 4630.8, it is DoD policy that all joint and combined operations be supported by compatible, interoperable, and integrated command, control, communications, and intelligence (C3I) systems. All C3I systems developed for use by U.S. forces are considered for joint use. The Director, Defense Information Systems Agency (DISA), serves as the DoD single point of contact for developing information technology standards to achieve interoperability and compatibility. All C3I systems and equipment shall conform to technical and procedural standards for compatibility and interoperability.

3. MIL-STDs in the 188 series (MIL-STD-188-XXX) address telecommunications design parameters based on commercial-off-the-shelf (COTS) technologies and are to be used in all new DoD systems and equipment, or major upgrades thereto, to ensure interoperability. The MIL-STD-188 series is subdivided into a MIL-STD-188-100 series, covering common standards for tactical and long-haul communications; a MIL-STD-188-200 series, covering standards for tactical communications only; and a MIL-STD-188-300 series, covering standards for long-haul communications only. Emphasis is being placed on the development of common standards for tactical and long-haul communications (the MIL-STD-188-100 series). The MIL-STD-188 series may be based on, or make reference to, American National Standards Institute (ANSI) standards, International Telecommunications Union - Telecommunication Standardization Sector (ITU-T) recommendations, International Standards Organization (ISO) standards, North Atlantic Treaty Organization (NATO) standardization agreements (STANAG), and other standards, wherever applicable.

4. This standard complies with Joint Staff direction requiring that a new standard be developed to define all technical characteristics essential for interoperability and performance of satellite communications (SATCOM) terminals that use 5- and 25-kHz ultra high frequency (UHF) demand-assigned multiple access (DAMA) SATCOM transponder channels. This standard defines mandatory system parameters for planning, engineering, procuring, and using UHF SATCOM terminals in joint operations.

5. Beneficial comments and any pertinent data which may be of use in improving this standard should be addressed to:

Defense Information Systems Agency
Joint Interoperability and Engineering Organization
ATTN: JEBBA
Fort Monmouth, NJ 07703-5613

by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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CONCLUDING MATERIAL 215

1. SCOPE

1.1 Purpose. This standard establishes mandatory requirements applicable to satellite communications (SATCOM) terminals required for time-division multiple access (TDMA)/demand-assigned multiple access (DAMA) operation over 5-kHz and 25-kHz ultra high frequency (UHF) SATCOM channels. The requirements specified herein represent the minimum set required for interoperability along with desirable terminal design objectives. Such requirements may be exceeded by equipment developers to satisfy specific Department of Defense (DoD) requirements, provided that interoperability is maintained. For example, the incorporation of additional standard and nonstandard interfaces is not precluded.

1.2 Scope. This standard is mandatory within the DoD and shall be invoked by equipment specifications for all future terminals required to operate in the DAMA mode over 5-kHz and 25-kHz UHF SATCOM channels. Existing terminals undergoing major modification and terminals under development will conform to this standard if DAMA operation over 5-kHz and 25-kHz UHF SATCOM channels is required.

1.3 Application guidance. In this standard, the word *shall* identifies mandatory system standards. The word *should* identifies design objectives that are desirable but not mandatory. The terms *system standard* and *design objective* are defined in FED-STD-1037.

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 5 of this standard. This section does not include documents cited in other sections of this standard or documents cited in sections 3, 4 and 5 as recommended sources for additional information or examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements within documents cited as mandatory in sections 3, 4, and 5 of this standard, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the versions of these documents are those listed in the current issue of the DoD Index of Specifications and Standards (DoDISS) and supplements thereto cited in the solicitation.

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-C-28883	*Military Specification for the ANDVT, AN/USC-43(V)*
NSA NO. 82-2	*NSA Performance and Interface Specification for TSEC/KG-84A, General Purpose Encryption Equipment (GPEE)*
NSA NO. 87-01	*KGV-11 and KGV-11(E2) Interface Specification*
NSA NO. 88-4	*National Security Agency Interface Specification for THORNTON COMSEC/TRANSEC Integrated Circuit (CTIC)*
NSA NO. CSESD-14	*Communications Security Equipment System Document for TSEC/KY-57/58*

(Copies of MIL-C-28883 are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Copies of NSA documents are available from the Director, National Security Agency, ATTN: V32, 9800 Savage Road, Fort George G. Meade, MD 20755-6000.)

STANDARDS

FEDERAL

FED-STD-1037	*Glossary of Telecommunication Terms*
FED-STD-1016	*Telecommunications: Analog to Digital Conversion of Radio Voice by 4,800 Bit/Second Code Excited Linear Prediction (CELP)*

(Copies of the above standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

DEPARTMENT OF DEFENSE

MIL-STD-188-181	*Interoperability Standard for Single-Access 5-kHz and 25-kHz UHF Satellite Communications Channels*
MIL-STD-188-182	*Interoperability Standard for 5-kHz UHF DAMA Terminal Waveform*

(Copies of the above standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DoD

DoDISS	*Department of Defense Index of Specifications and Standards*

[Copies of the DoDISS are available by yearly subscription either from the Superintendent of Documents, U.S. Government Printing Office, Washington DC, 20402 (for hard copy), or from the Defense Printing Service Detachment Office, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094 (for electronic media)].

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DoD adopted, are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues cited in the solicitation.

IBM

GA27-3004	*General Information -- Binary Synchronous Communications, IBM Systems Journal, Reference Library, GA27-3004 (1970)*

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. DEFINITIONS

3.1 Terms. Terms not listed below are defined in FED-STD-1037.

3.1.1 Access. The ability, permission, or liberty to communicate with, or make use of, any system resource.

3.1.2 Active ranging. The transmission and subsequent reception of a burst signal used for estimating the range to a satellite.

3.1.3 Address. A 16- or 14-bit code that uniquely identifies a terminal input/output (I/O) port or network.

3.1.4 Automatic control (AC). An operating mode that allows communications slots within the waveform to be dynamically assigned to terminals requiring access to the slots.

3.1.5 Binary phase-shift keying (BPSK). A form of PSK in which the instantaneous phase of the carrier can be either unchanged or shifted 180 degrees. The information content of an uncoded BPSK signal is 1 binary digit (bit) per symbol; therefore, the symbol rate and the information rate are identical.

3.1.6 Bit synchronization (clock lock). The condition achieved when significant transitions of the recovered data rate clock are phase-stable to within 25 percent of the bit period.

3.1.7 Burst. A time-limited transmission composed of a synchronization preamble and a finite-length data stream that are formatted into interleaver block pairs.

3.1.8 Burst rate. The over-the-air transmission rate (modulation rate) in symbols per second (sps).

3.1.9 Carrier acquisition. The condition achieved when a receiver carrier reference is coherent in frequency and phase with the receive signal.

3.1.10 Channel control orderwire (CCOW) acquisition. The terminal's status when it has successfully achieved error free reception of a CCOW:Master Frame (checked by CRC).

3.1.11 CCOW time slot. The time slot through which a terminal receives CCOW transmissions.

3.1.12 Channel control orderwire (CCOW). The transmissions from a controller that control the waveform and its usage, such as frame number, encryption synchronization counts, user time slot assignments, and frame format in current use.

3.1.13 Channel resources. The available time, bandwidth, and power of a channel.

3.1.14 Circuit number. A 5-digit decimal number that identifies a time slot when operating in the DC mode.

3.1.15 Control channel. A 25-kHz DAMA channel on which a channel controller (CC) transmits CCOW messages and the frame is segmented for terminals to transmit return channel control orderwire (RCCOW), link test, ranging, and user communications signals.

3.1.16 Controller. An entity that establishes frame format and system timing. In the AC mode a controller also assigns waveform access to users.

3.1.17 Cyclic Redundancy Check (CRC). A type of error-detection scheme that uses parity bits generated by polynomial encoding and decoding algorithms to detect transit-generated errors.

3.1.18 Demand-assigned single access (DASA). An access scheme in which a SATCOM channel is assigned for single access through the DAMA control system in accordance with demand.

3.1.19 Differentially encoded quadrature phase-shift keying (DEQPSK). Quadrature phase-shift keying (QPSK) that has been differentially encoded. DEQPSK is used to resolve the phase ambiguity of digital data recovered from demodulation. It is not used for error detection or correction. See 5.5 and *QPSK*.

3.1.20 Distributed control (DC). An operating mode in which a terminal's access to a communications slot is preassigned (both time slot and frame format).

3.1.21 Even link test time slot. A link test time slot used to perform dedicated ranging measurements when the receive frame count is even.

3.1.22 Field. A specific portion of a message.

3.1.23 Fill bits. Fill bits are used to complete the last interleaver block and must be zero.

3.1.24 Flush bits. All-zero bits added to a data field prior to encoding to provide proper convolutional encoder operation.

3.1.25 Format. The structuring of a frame into time slots for the transmission and reception of CCOW, RCCOW, ranging, link test, and user communications bursts.

3.1.26 Format number 1. The frame structure in effect when subformat B-1 is selected. Used to reduce contention for half-duplex terminals [at radio frequency (rf)] that require communications on two 2400-bps circuits.

3.1.27 Format number 2. The frame structure in effect when subformats B-00 or B-2 through B-F are selected.

3.1.28 Frame. A unit of time on a channel. A frame is 1.3866... seconds long and is subdivided into waveform overhead slots and user time segments. (See *Frame subformat*.)

3.1.29 Frame count. The sequence in which a particular frame occurs. The frame count is defined by a 21-bit field transmitted by the controller in each master frame.

3.1.30 Frame format. The frame time-slot configuration defined by the combination of frame subformats in use for user segments A, B, and C. Also refers to the 3-digit hexadecimal (HEX) code used to specify this configuration.

3.1.31 Frame lock. The status a terminal achieves when it has received and detected the precise location of two consecutive CCOWs. A terminal that achieves this status is considered to have properly established receive frame timing.

3.1.32 Frame lock loss. The condition of a terminal that has not decoded any CCOW for 5 minutes for DC mode and 2 minutes for AC mode.

3.1.33 Frame subformat. The time-slot configuration of user communications segments A, B, or C. Also refers to the 1-digit HEX code used to specify this configuration.

3.1.34 Frame time delay. Time delays introduced due to conversion of a continuous data stream into burst-formatted data blocks.

3.1.35 Frequency code. An 8-bit code that defines the uplink and downlink frequency pair of a satellite transponder.

3.1.36 Frequency switched connection. A time-slot connection on a channel other than the one where the terminal receives CCOW.

3.1.37 Frequency switching. The ability of a terminal to transmit and receive in multiple channels within the same frame.

3.1.38 Frequency uncertainty. The difference between a received signal's expected frequency and its actual frequency. Frequency uncertainty results when (1) a difference in frequency between reference oscillators exists, (2) doppler effects cause frequency shifts, or (3) frequency-setting inaccuracies occur.

3.1.39 Full duplex. (1) Communications that occur in both directions (transmit and receive) within one frame. (2) A terminal characteristic that signifies the capability to simultaneously receive and transmit rf signals.

3.1.40 Guard group. A group of terminals that have a common guard address.

3.1.41 Guard list. A set of addresses for which a terminal receives services.

3.1.42 Guard time. Time interval within a frame that prevents overlap of transmissions that could occur due to timing differences between transmitting terminals.

3.1.43 Half duplex. A terminal characteristic that allows receipt and transmission of signals, but not both at the same time.

3.1.44 Home channel. The control channel that a terminal uses to receive its CCOW messages and transmit its RCCOW and other system support messages.

3.1.45 Inclination angle. The angle between a satellite's orbital plane and the earth's equatorial plane.

3.1.46 Indicator. A symbol, flag, or signal that serves to identify a specific state or item.

3.1.47 Input/output (I/O) data rate. The rate in units of bits per second (bps) at which bits are sent to or received from an I/O device.

3.1.48 Key generator (KG) day. A 3-bit code that defines the daily or weekly mode of operation used to prepare the orderwire KG.

3.1.49 KG memory. A 3-bit code that defines one of eight memory locations in which the KG keys used for orderwire encryption and decryption are stored.

3.1.50 KG net number. A 5-bit code used to prepare the KG, which encrypts the CCOW and RCCOW.

3.1.51 KG ID number. A unique 16-bit identification number associated with the orderwire encryption/decryption device. The KG ID number is the same as the terminal base address.

3.1.52 Link test time slot. A shared time slot used by a terminal to evaluate its link conditions or measure two-way range to the satellite. A link test is performed only in odd-numbered frames; range measurements are performed only in even-numbered frames.

3.1.53 Master frame. A frame occurring once in every eight frames that identifies the current waveform format and other configuration parameters.

3.1.54 Master frame epoch. A set of eight contiguous frames, beginning with a master frame.

3.1.55 Modulo. A mathematical function that yields the remainder of a division.

3.1.56 Nonregenerative transponder. A transponder (e.g., a satellite repeater) in which digital signals are not reconstituted.

3.1.57 Operator. The person who controls and operates a communications terminal or controller.

3.1.58 Orderwire. The portions of a TDMA frame used for transmission of management, control, and status information between channel controllers and terminal users. See *channel control orderwire (CCOW)* and *return channel control orderwire (RCCOW)*.

3.1.59 Originator. A person or terminal that initiates a communication.

3.1.60 Pad bits. Pad bits are used both before and following user data when insufficient user data is present to fill the data portion of a burst.

3.1.61 Passive ranging. A process by which a terminal determines signal propagation time to a satellite by means other than transmitting a ranging signal.

3.1.62 Preassigned service. A type of service whose time-slot assignment is scheduled and set up well in advance of being used.

3.1.63 Preempted service. A service that has been interrupted to allow for higher-precedence services.

3.1.64 Quadrature phase-shift keying (QPSK). A form of PSK in which the instantaneous phase of the carrier can be either unchanged, shifted ±90 degrees, or shifted 180 degrees. QPSK may be represented as two independent binary bit streams modulated onto the in phase (I) and quadrature phase (Q) components of the carrier. The information content of a QPSK signal is 2 binary digits (bits) per symbol; therefore, the symbol rate is one-half the information rate.

3.1.65 Queued service. A service request in queue, waiting to be assigned communications resources.

3.1.66 Range. The round-trip distance between a satellite and a terminal within the satellite footprint. (Because signal propagation velocity is constant, terminals measure range in units of time.)

3.1.67 Range lock. The status a terminal achieves when it has determined its range time delay with an uncertainty of less than or equal to 875 microseconds (Fs). [Terminal transmissions are inhibited (except for active ranging transmissions) until the terminal achieves this status.]

3.1.68 Range time slot. A shared slot used to measure two-way range to the satellite.

3.1.69 Ranging. A process by which a terminal determines the propagation time to the satellite: to establish uplink timing. See *active ranging* and *passive ranging*.

3.1.70 Ranging epoch interval. The interval between scheduled dedicated ranging attempts by a terminal.

3.1.71 Requested party. The address to which a call is placed.

3.1.72 Requesting party. The address of the I/O port initiating a call.

3.1.73 Return channel control orderwire (RCCOW). A TDMA slot used by the terminals to (1) request, from the channel controller, access to the waveform; (2) respond to channel controller requests with information such as status and configuration; and (3) transfer computer data to other terminals.

3.1.74 Satellite footprint. The area of the earth's surface from which terminals are able to access a particular satellite.

3.1.75 Segment. A portion of a frame allocated to users for communicating. The segment is further divided into time periods called time slots.

3.1.76 Service. A specified set of information transfer capabilities provided to a group of users by a DAMA system.

3.1.77 Slant range. The one-way distance between a satellite and a terminal within the satellite's footprint. (Because signal propagation velocity is constant, terminals measure range in units of time.)

3.1.78 Slave channel. A DAMA channel (5- or 25-kHz) used only for user communications and not for reception or transmission of orderwire or system support messages. Channel timing is derived from synchronization with the CCOW on the control channel.

3.1.79 Slot connect. A connection between a terminal's I/O port(s) and a communications slot in a TDMA frame.

3.1.80 Slot number. A 5-bit code that identifies a time slot when operating in the AC mode.

3.1.81 Special frame format. A frame format in which one or more of a terminal's subformats may differ from the frame format indicated in the master frame.

3.1.82 Subformat. See Frame subformat.

3.1.83 Symbols per second (sps). The unit of measure of the modulation rate. The modulation rate in sps is calculated by dividing the bit rate, after forward error correction (FEC), by the number of bits per symbol.

3.1.84 System support slots. Those portions of a control channel allocated for terminals to perform link test and ranging operations.

3.1.85 Terminal base address. The address of the lowest numbered I/O port attached to a terminal.

3.1.86 Time chip. One cycle of a 19,200-Hz oscillator (approximately 52 microseconds).

3.1.87 Time slot. A fraction of the TDMA frame allocated for a specific control function or support function (CCOW, RCCOW, Range, and Link Test) or user communications.

3.1.88 User time slot. A fraction of the waveform frame that carries user-to-user communications (such as encryption preambles, independent network protocols, and encrypted data).

3.1.89 Waveform. The combination of baseband signal structure, rf signal structure, and communications protocols that provides a framework within which coordinated communications can be effected.

3.2 Abbreviations and acronyms. The abbreviations and acronyms used in this standard are defined as follows:

AC	automatic control
ACE	adjacent channel emissions
ANDVT	Advanced Narrowband Digital Voice Terminal
BCD	binary-coded decimal
BER	bit error rate
bps	bits per second
BPSK	binary phase-shift keying
BSC	binary synchronous communications
CALL ACK	Call Acknowledgment
CC	channel controller
CCOW	channel control orderwire
CELP	code-excited linear prediction
COMSEC	communications security
CRC	cyclic redundancy check
CTIC	COMSEC/TRANSEC Integrated Circuit
CVSD	continuously variable slope delta

DAMA	demand-assigned multiple access
DASA	demand-assigned single access
dB	decibel
dBW	decibel referenced to 1 watt
DC	distributed control
DEQPSK	differentially encoded quadrature phase-shift keying
DISA	Defense Information Systems Agency
DoD	Department of Defense
DoDISS	DoD Index of Specifications and Standards
E_b/N_o	energy-per-bit to noise-power-spectral-density ratio
EIRP	effective isotropically radiated power
ECM	embedded CTIC module
ELT	even link test
FEC	forward error correction
FLTSATCOM	fleet satellite communications
FSCS	Fleet Satellite Communications System
HEX	hexadecimal
Hz	hertz (cycles per second)
I	in phase
ID	identification
I/O	input/output
JCS	Joint Chiefs of Staff
kbps	kilobit(s) per second
KG	key generator
kHz	kilohertz
ksps	kilosymbol(s) per second
LEASAT	leased satellite
LPN	Legendre polynomial
LSB	least significant bit
MIL-STD	military standard
ms	millisecond
MSB	most significant bit
N/A	not applicable
nm	nautical mile
NMCS	National Military Command System
OTAR	over-the-air rekeying
ppm	part(s) per million
PSK	phase-shift keying

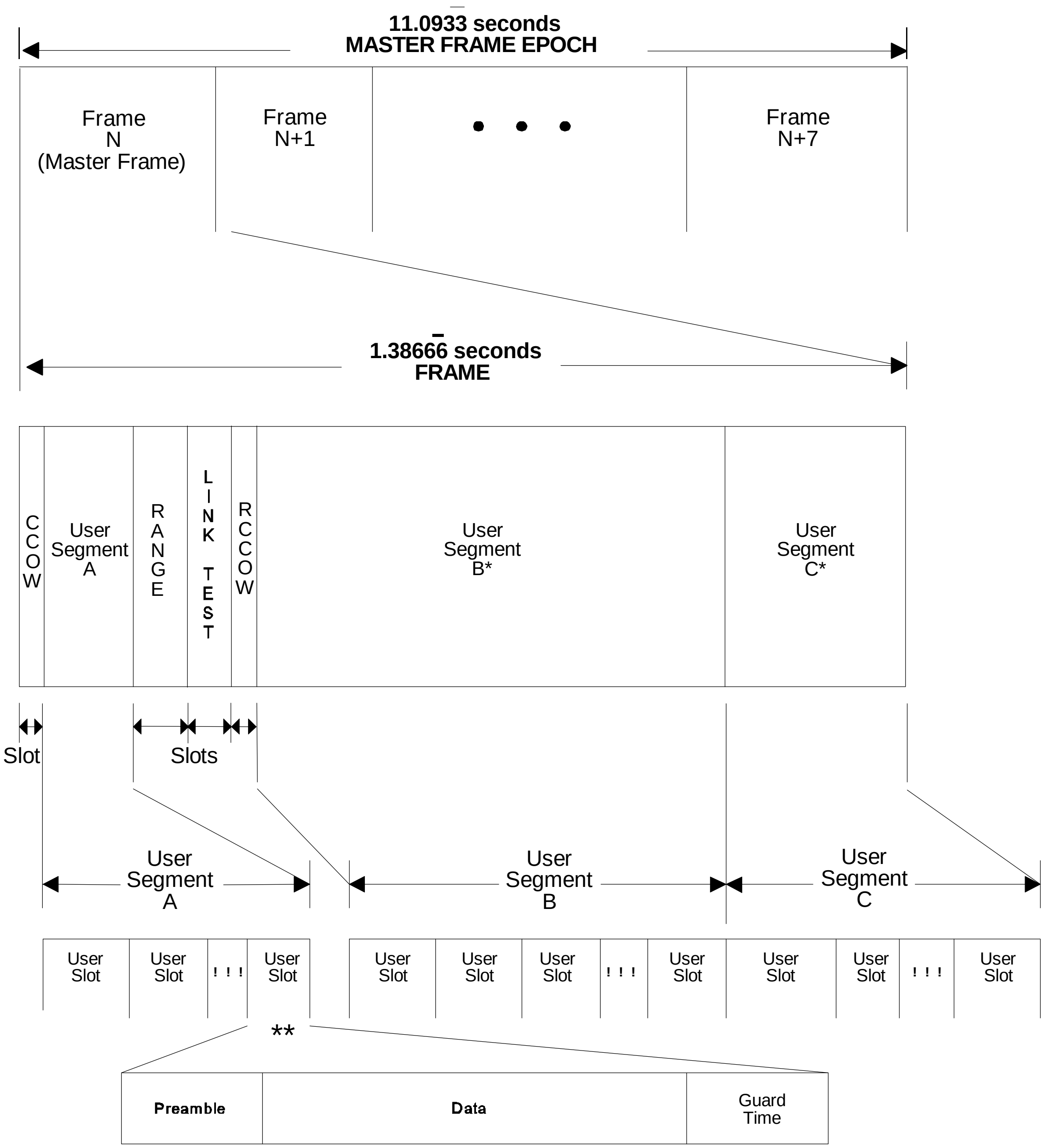
Q	quadrature phase
QPSK	quadrature phase-shift keying
RCCOW	return channel control orderwire
rf	radio frequency
RFI	radio frequency interference
R/T	receiver/transmitter
SATCOM	satellite communications
SOQPSK	shaped offset quadrature phase-shift keying
sps	symbols per second
TDMA	time-division multiple access
TRANSEC	transmission security
TS0	Time Slot Zero
UHF	ultra high frequency
μs	microsecond

4. GENERAL REQUIREMENTS

4.1 TDMA/DAMA. The waveform defined in this standard allows multiple users to access a single, nonregenerative 5-kHz or 25-kHz ultra high frequency (UHF) satellite transponder. The waveform also allows an automatic controller to have either preassigned or real-time control of multiple channels. The waveform provides for two modes of operation: automatic control (AC) and distributed control (DC). This standard defines the minimum interoperability requirements for a terminal to function in the AC and DC modes and specifies minimum optional requirements for a terminal to operate as a DC mode channel controller. The waveform accommodates multiple input/output (I/O) bit rates and radio frequency (rf) symbol burst rates as well as the dynamic assignment of users between channels. Operation of the waveform is transparent to the user baseband equipment except for TDMA frame-time delays.

4.2 General waveform structure. Multiple access to a single channel is supported using a communications technique known as time-division multiple access (TDMA). In TDMA the channel time is divided into repetitive equal-length intervals known as *frames*. The frames for this waveform, which have a duration of 1.3866... seconds, are subdivided into smaller time intervals known as *time slots*. There are three general types of time slots: (1) orderwire time slots, used for access control and timing, (2) system support time slots, used for terminal ranging and link quality testing, and (3) user time slots (also called communications time slots or slots), employed for baseband communications. Channels with frames having all three types of time slots are hereinafter referred to as *control channels*. In this waveform, only 25-kHz channels can be configured as control channels. Figure 1 depicts the frame structure of a 25-kHz control channel (format number 2 is depicted). Format numbers 1 and 2 are discussed in 5.1.1.1. Channels with frames having only communications time slots are hereinafter referred to as *slave channels*. Both 5-kHz and 25-kHz channels can be operated as slave channels. 25-kHz slave channels use the same user segments as control channels. Figure 2 depicts the user segment structure for 5-kHz slave channels.

4.2.1 Control channel frame format. The 25-kHz control channel frame is subdivided into time slots assigned for (a) orderwire communications [channel control orderwire (CCOW) and return channel control orderwire (RCCOW)]; (b) system support functions (range time slot and link test time slot); and (c) user segments A, B, and C. User segments A, B, and C each comprise multiple user time slots, as shown on Figure 1 and specified in 5.1.1.2. The TDMA frames are sequentially numbered. The frame count is started at 24 by a CCOW:Time Slot Preparation message described in 5.2.1.1.2.17 and is incremented by one until the next CCOW:Time Slot Preparation message.



* Format number 2 is shown here for illustration purposes. Position and length of these segments/slots vary, depending on selected frame format.

** Depicted are the three parts of a user time slot (preamble, data, and guard time).

FIGURE 1. General 25-kHz TDMA/DAMA waveform.

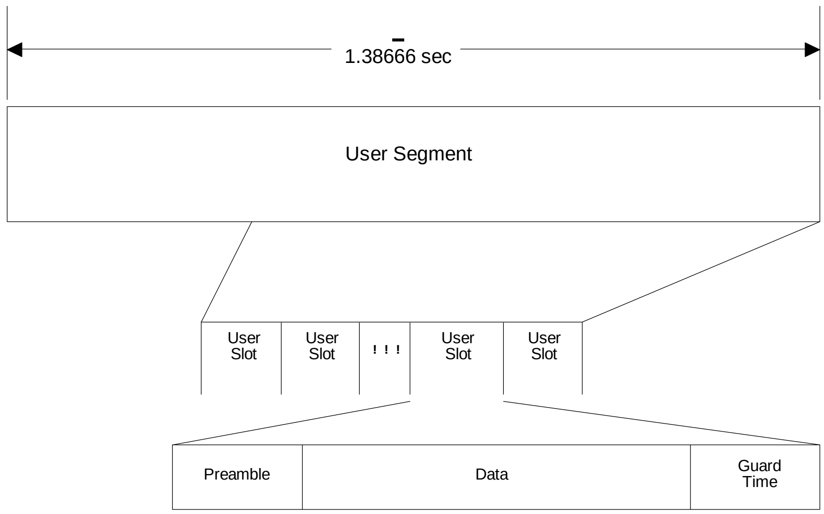


FIGURE 2. 5-kHz slave channel frame format.

When the three least significant bits (LSB) of the frame count are all zeros, the frame is known as a *master frame*. A set of eight contiguous frames, beginning with a master frame, defines a master frame epoch. Each of the five types of time slots required for interoperability in the 25-kHz TDMA/DAMA waveform is defined below:

a. CCOW time slot. The channel controller broadcasts a CCOW message during the CCOW time slot in each frame. The CCOW message contains information required for controlling access to 5-kHz slave and 25-kHz control and slave channel time slots.

b. RCCOW time slot. The RCCOW time slot provides time for users to send information (including requests for access to user and system support time slots) to the channel controller and to transfer computer data to other terminals.

c. Range time slot. The range time slot provides time for users (including the channel controller) to transmit and receive their own data stream for the purpose of calculating range to the satellite, based on measured round-trip propagation time.

d. Link test time slot. The link test time slot provides time for users (including the channel controller) to transmit and receive a test data stream to determine the current operating conditions, based on measured bit error ratio (BER) and C/N_o. The link test time slot is also used to perform dedicated ranging measurements, as specified in 5.1.4.1.2, when the link test time slot is in an even-numbered frame. This is known as an *even link test (ELT)* time slot.

e. User time slot. User time slots are allocated for transferring baseband data between and among users. User time slots have associated with them specific baseband, coding, and burst rates.

4.2.2 Slave channel frame format. Channels designated as slave channels are used only for user communications and are not employed for orderwire message exchange or other system support functions. User communications are provided on these channels, as discussed in 4.2.2.1 and 4.2.2.2.

4.2.2.1 25-kHz slave channel frame. A 25-kHz slave channel frame has no time slots allocated for orderwire exchange or system support functions. The possible user segment subformats are the same as those available in the control channel frame defined in 4.2.1. Figures A-1 through A-3 depict 25-kHz user segment time slots.

4.2.2.2 5-kHz slave channel frame. A 5-kHz slave channel frame has designated time slots for user communications (see Figure 2). A 5-kHz slave channel frame has no time slots allocated for orderwire exchange or system support functions. Figure A-4 depicts 5-kHz slave channel user segment time slots.

4.3 Time slot structure. Each transmission within either a control or slave channel time slot consists of two elements: (1) a synchronization element (preamble) -- a known signal the receiver needs for carrier, bit, and data synchronization -- and (2) a data element in which the information is transmitted. Guard time is allocated for each time slot to avoid user-to-user interference across adjacent time slots. The receiving equipment achieves carrier and bit synchronization for each burst within a time slot in the waveform.

4.4 User access and waveform control. The method of user access to communications time slots within the waveform depends on whether the waveform is operated in the AC or DC mode.

4.4.1 DC mode. In the DC mode, access to communications time slots is prearranged. The channel's frame format shall be made known to the terminal operator in this mode. Communications time slots are uniquely numbered and preassigned for specific purposes. Figures A-1 through A-3 illustrate the multiple combinations of configurations of communications time slots in each user segment based on the format specified for each segment. The terminal operator interface is used to directly connect the terminal I/O ports to communications time slots. The operator selects the satellite channel on which the terminal operates.

4.4.2 AC Mode. In the AC mode, terminal access to either 5-kHz or 25-kHz channel communications time slots is assigned through CCOW messages transmitted by the channel controller (CC) on a control channel (the terminal's home channel). A terminal shall use the home channel to receive and transmit all orderwire messages. Through exchange of orderwire messages, terminals may request or be directed to communicate in a time slot on (1) the terminal's home channel, (2) another 25-kHz control channel, (3) a 25-kHz slave channel, (4) a 5-kHz slave channel, (5) a 25-kHz demand-assigned single access (DASA) channel, (6) a 5-kHz DASA channel, or (7) a MIL-STD-188-182-compliant 5-kHz DAMA channel. All terminals shall be automatic frequency-switching capable and shall switch to the appropriate channel as directed by the controller. When directed to a DASA channel, terminals shall operate in accordance with MIL-STD-188-181. When directed to a 5-kHz DAMA channel, operation shall be as specified in MIL-STD-188-182. When a terminal is assigned to communicate in a time slot on another 25-kHz control channel or a 5-kHz or 25-kHz slave channel, the terminal shall frequency-switch to that communications channel during the period of the assigned time slot to transmit and receive baseband data. Terminals that report (see 5.2.1.2.2.10 h) they are not configured for automatic frequency-switching will not be assigned to communicate on a channel other than their home channel. The terminal shall continue to exchange orderwire messages on its home channel. There is no requirement for a terminal operator to know the frame format on an AC channel. A channel's frame format and subformat can be dynamically adjusted by the controller to reflect changing communications demands and priorities. When the frame format of the channel on which the terminal is being assigned a communications time slot is different from the frame format of a terminal's home channel, the channel controller will send a CCOW:Special Format Change Order to the terminal prior to issuing a time-slot connection command (see 5.2.1.1.2.4 and 5.2.1.1.2.7). A terminal shall also perform link tests (as assigned) and ranging in the appropriate system support time slots on its home channel.

4.5 System timing. The terminal shall achieve CCOW acquisition on the home channel for network entrance and frame synchronization. A terminal shall determine the location of user time slots on its home channel, on another control channel, or on a slave channel relative to the CCOW time slot on its home channel. The channel controller will direct terminals to communicate on slave channels and other control channels only if they are on the same satellite as the home channel.

4.6 Orderwire messages. The terminal shall be able to receive and process CCOW commands (see Tables I and II) and generate RCCOW requests and responses (see Tables III and IV).

4.7 User terminal I/O ports. There shall be a maximum of eight I/O ports per terminal. Applications requiring more than eight I/O ports shall consist of two or more logical terminals, each with a maximum of eight I/O ports. The lowest numbered I/O port is the terminal base address, and the address for each I/O port shall be sequentially assigned starting with the terminal base address.

TABLE I. CCOW messages, AC mode.

COMMAND	PURPOSE
Master Frame	Establishes channel timing and crypto synchronization.
No Command	Sent when the channel controller has no other command to issue.
Slot Disconnect	Cancels user time slot assignment. Disconnects one or more users from a communications time slot or tears down an entire communications service.
Slot Connect	Assigns a user time slot for baseband communications on a 25-kHz control channel, or a 5- or 25-kHz slave channel.
Link Test and Range Frame-Number Assignment	Authorizes use of link test time slots or assigns a new dedicated range time slot.
Channel Control Handover Request	Coordinates handover of control to new controller.
Special Format Change Order	Directs waveform frame format change.
Call Canceled	Notifies user that a requested call is canceled.
TDMA Channel Reassignment	Assigns a terminal to a new home channel or a MIL-STD-188-182 channel.
DASA Channel Assignment	Assigns a communications service on a 5- or 25-kHz DASA channel for the duration of a call or until a timer expires.
Enter Guard List	Enters addresses into a terminal's guard list.
Delete from Guard List	Deletes addresses from a terminal's guard list.
Call Waiting	Notifies user that call from another user is waiting.
Call In Queue	Notifies user that requested call has been placed in queue.
Computer Data Transfer	Transfers data (4 bytes) to user.
Information Request	Asks user for status information report; disconnects constant key offender; communicates information from a controller to a user.
Zeroize	Zeroizes orderwire encryption device.
Time Slot Preparation	Directs change in orderwire encryption device preparation.
Requested Party Out-of-Service	Notifies user that requested party is not available.
Transmit Control	Enables or inhibits all transmissions on a channel.
Satellite Ephemeris Data (Message 1, 2 or 3)	Provides satellite ephemeris data for the two satellites in the coverage area.

TABLE II. CCOW messages, DC mode.

COMMAND	PURPOSE
Master Frame	Establishes channel timing and crypto synchronization.
No Command	Sent when the channel controller has no other command to issue.
Information Request	Asks user for status information report; disconnects constant key offender.
Zeroize	Zeroizes orderwire encryption device.
Time Slot Preparation	Directs change in orderwire encryption device preparation.

TABLE III. RCCOW messages, AC mode.

COMMAND	PURPOSE
Status Report B	Reports terminal I/O port configuration and status.
Data Transfer (Type A or Type B) (optional)	Transfers data between users.
Link Test Request	Requests access to link test time slot.
Call Complete	Notifies controller that user is finished with call.
Out-of-Service	Notifies controller that user I/O port will not be available for connections for an estimated period of time.
Information Report	Responds to information request; reports constant key condition.
Two-Party Request	Requests connection to one party or to a network.
Conference Request	Requests establishment of a conference call with up to five users.
Conference Party List	
C/N_o and Link Test Results	Reports C/N_o and link test results.
Status Report A	Reports terminal communications capabilities and I/O port connection status.
Acknowledge Channel Control Request	Acknowledges channel control handover request (used only by terminal performing channel control function).
Guard List Report	Reports current guard lists.
Paging	Requests paging of up to three parties.
Cancel Call (Two Party or Conference)	Requests cancellation of call.

TABLE IV. RCCOW messages, DC mode.

COMMAND	PURPOSE
Data Transfer (Type A or Type B)(optional)	Transfers data between users.
Information Report	Responds to information request; reports constant key condition.

4.8 Terminal performance requirements. The terminal transmit power received at the satellite shall be at least -163 decibels (dB) relative to 1 watt (dBW). The terminal receiver system shall be designed to provide error-free reception of the CCOW burst for at least 999 of 1000 CCOW bursts, with a confidence of 98 percent when the controller power received at the satellite is at least -163 dBW. Error-free reception requires both successful acquisition of the burst and error-free reception of all data covered by the CRC. Terminal specifications should define the parameters that must be met to comply with the requirements of this paragraph.

5. DETAILED REQUIREMENTS

5.1 Waveform characteristics.

5.1.1 TDMA frame structure. The TDMA frame has a duration of 1.3866... seconds. On a control channel the frame includes the following: (1) a CCOW time slot for control commands and synchronization; (2) an RCCOW time slot for terminal access requests and status reports; (3) a range time slot for ranging; (4) a link test time slot for ranging and link quality evaluation; and (5) user segments A, B, and C. A 25-kHz slave channel consists only of user segments. The user segments are further divided into user time slots. Positioning of the various time slots within the frame can be in format number 1 or format number 2, as shown on Figure 3. Terminals shall be able to operate on 25-kHz channels within the frame format configuration and restrictions defined in 5.1.1.1 a. None of the five types of time slots shall be used for any purpose other than as specified in this standard. Terminals shall transmit only in a time slot that is part of the current frame format or assigned special frame format (see 5.2.1.1.2.7). A 5-kHz slave channel consists only of a user segment as shown on Figure 2.

5.1.1.1 User segment structure.

a. 25-kHz channels. The structure of the user segments for both control and slave 25-kHz channels can be arranged in a TDMA frame in either of two ways as shown on Figure 3. The subdivision of each user segment into time slots is defined by a hexadecimal subformat indicator. Valid subformat indicators are specified in Appendix A. (See circled values to left of Figure 4A for example.) TDMA format number 1 applies whenever the user segment B subformat indicator is 1. If the user segment B subformat indicator is a value other than 1, TDMA format number 2 applies.

1. Format number 1. In format number 1, the B segment is divided into two subsegments, B-1(A) and B-1(B), to allow half-duplex (at rf) terminals to fully participate in two 2400-bps circuits within the same frame. Format number 1 is used whenever subformat B-1 is selected. Any of the subformats of segments A and C may be selected.

2. Format number 2. Format number 2 is used whenever subformat B-1 is not selected. Any of the subformats of segment A may be selected. When subformat B-00 is selected, segment C is not used. The selection of subformat B-E restricts the C segment to an E selection as well. There are no other restrictions on selection of the C-segment subformat.

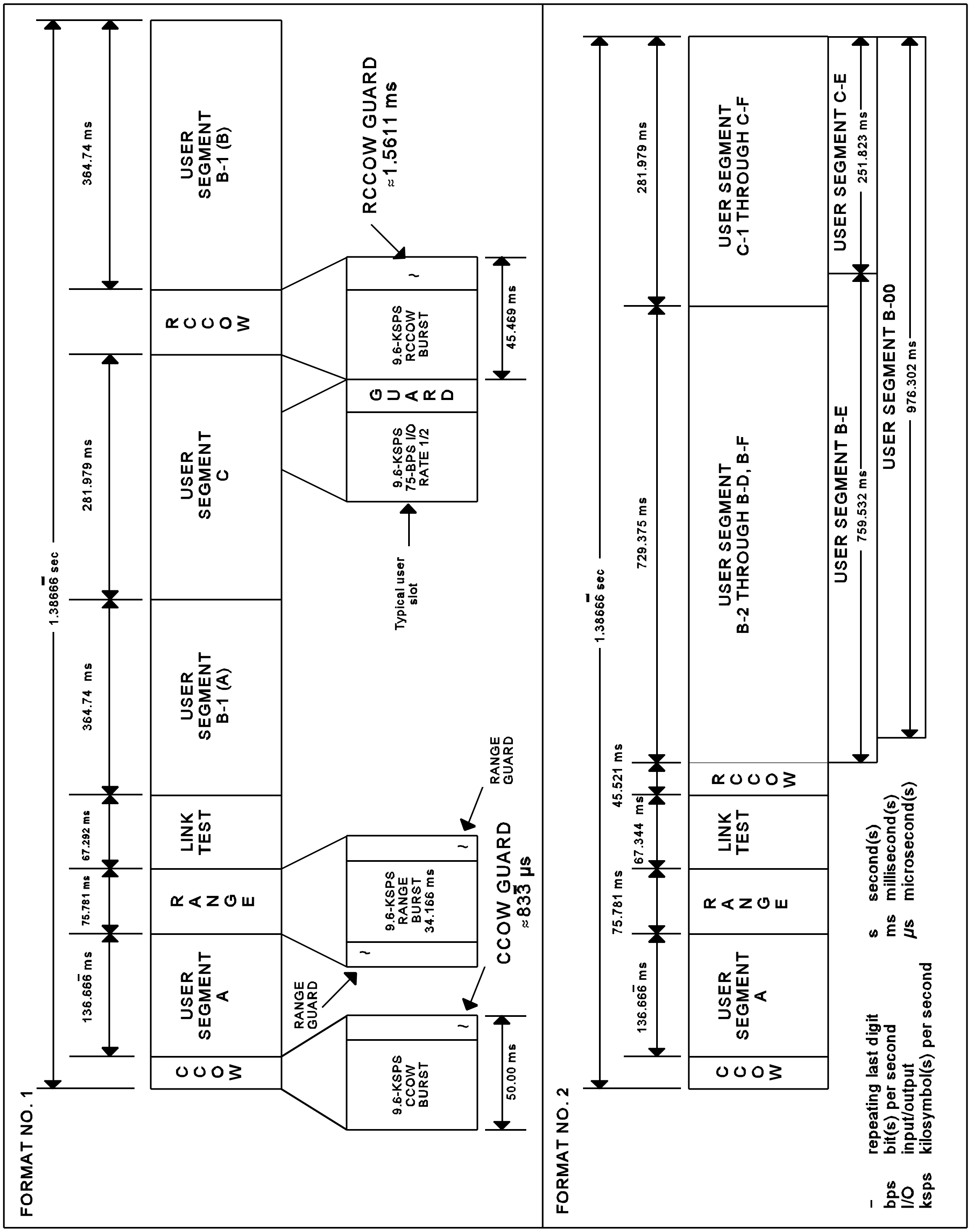


FIGURE 3. 25-kHz TDMA frame formats.

b. 5-kHz slave channels. The TDMA frame for 5-kHz slave channels includes only user time slots as shown on Figure 4B and in Appendix A, Figure A-4. The user time slots are allocated within the frame to provide the terminal with the capability to switch to the assigned 25-kHz control channel to receive the CCOW and employ the system support time slots without extensive conflicts for half-duplex (at RF) terminals. These conflicts would result from transmitting and receiving on a user time slot while at the same time needing to receive the CCOW or use the system support functions.

5.1.1.2 User time-slot structure. As shown on Figure 4 and in Appendix A, each user time slot has an associated baseband data rate [user data rate in bits per second (bps)], burst rate [over-the-air transmission rate in symbols per second (sps)], and forward error correction (FEC) code rate (1/2, 3/4, 7/8, or 1). Depending on the mode of operation (AC or DC), each 25-kHz user time slot is identified by an AC slot number (1-23, represented by a 5-bit code) used in combination with the frame format, or by a DC circuit number (a 5-digit code). For example, on Figure 4A (Typical 25-kHz channel user time slots) the leftmost user time slot in the first row (segment A-1) has an AC slot number of 1, a DC circuit number of 10033, a baseband data rate of 75 bps, a burst rate of 9.6 ksps, and a FEC code rate of 1/2. For 5-kHz slave channels, the same information is provided except there is no DC Circuit number required, the guard time may be allocated at the beginning and end of the time slot, and the total size of the time slot is provided as shown on Figure 4B.

5.1.2 Preamble structure. Each rf transmission shall begin with a synchronization preamble. The preamble structure, as it relates to the burst rates and time slot types, shall be as specified on Figure 5. The latter portion of the synchronization preamble shall be a Legendre polynomial (LPN) whose length is defined on Figure 5 and whose content is specified in Table V. The first symbol following the LPN is the first symbol of the time slot data field. The terminal's specification for bit error ratio (BER) and acquisition performance under degraded link conditions should be used to determine how many LPN bits must be correctly received for a burst to be considered acquired.

5.1.3 Timing requirements. To operate within the waveform, each terminal must adhere to receive and transmit timing requirements. Each 1.3866... second TDMA frame is subdivided into 26624 *time chips*, with each time chip having the duration of a single cycle of a 19.2-kHz clock. All timing within the frame is specified in units of time chips. Receive timing is attained when the terminal has achieved frame lock. Frame lock is initially achieved by the terminal when two consecutive CCOWs have been detected as described in 3.1.30. Frame lock is lost

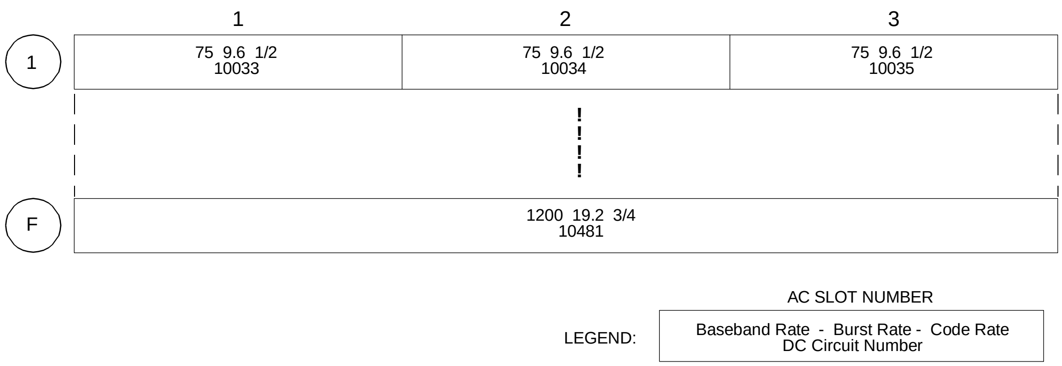


FIGURE 4A. Typical 25-kHz channel user time slots.

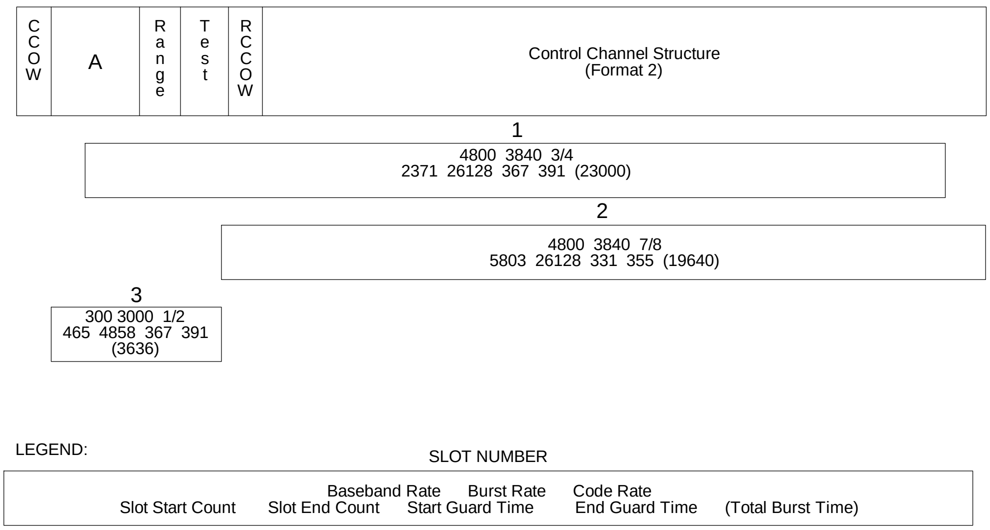
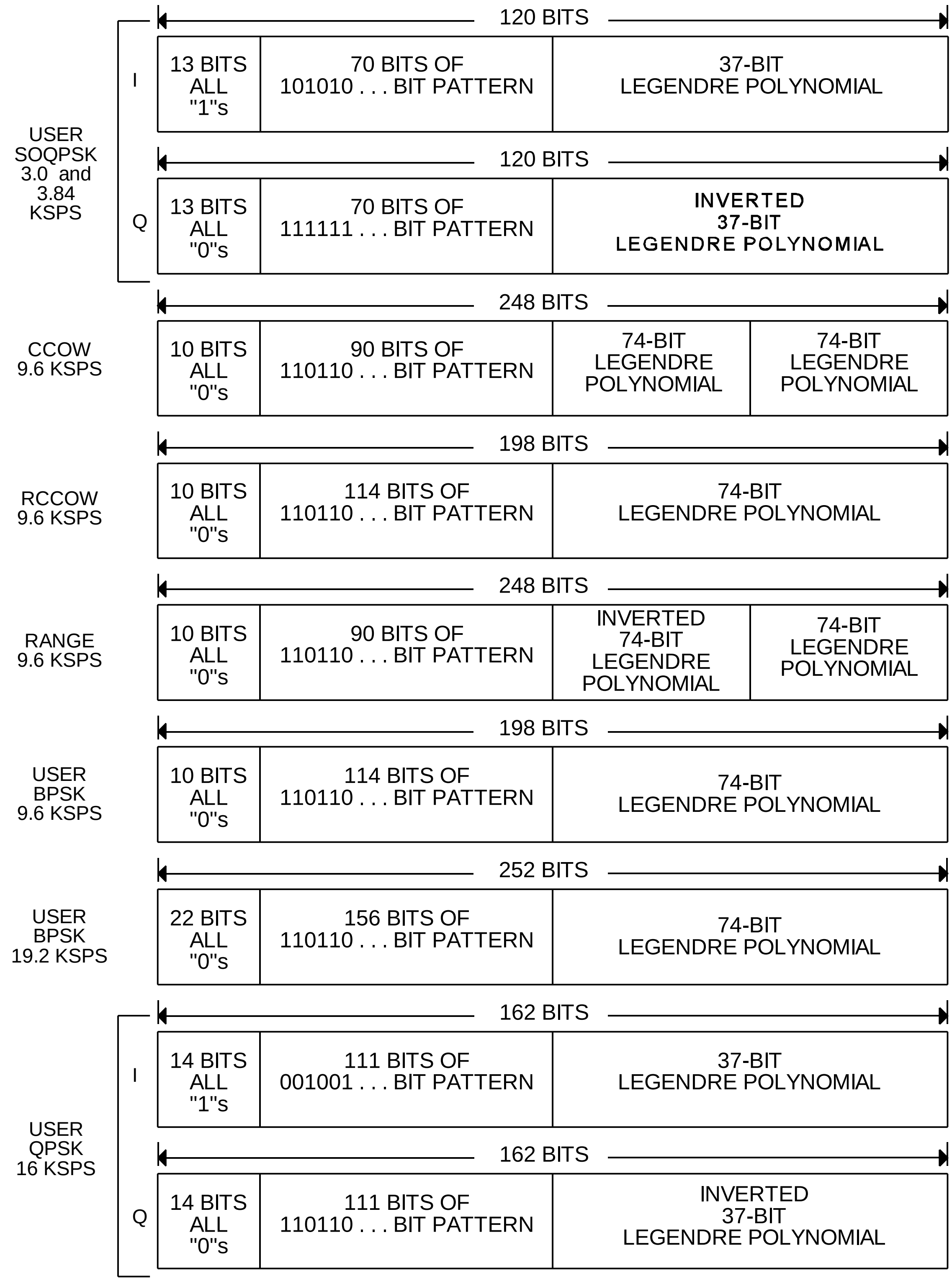


FIGURE 4B. Typical 5-kHz slave channel user time slots.

FIGURE 4. Typical user segment time slots.



NOTE : Terminals shall inhibit transmission of the leading zeros for BPSK channels and leading zeros (Q channel) and leading ones (I channel) for QPSK/SOQPSK channels in the preamble structures for 650 ± 150 μs.

FIGURE 5. Preamble structure.

TABLE V. Legendre polynomials.

74 LPN				37 LPN	
BIT NUMBER	STATE	BIT NUMBER	STATE	BIT NUMBER	STATE
1*	1	38	0	1	1
2	0	39	1	2	1
3	0	40	0	3	1
4	0	41	0	4	0
5	1	42	0	5	0
6	1	43	1	6	0
7	1	44	0	7	1
8	0	45	0	8	0
9	1	46	1	9	0
10	0	47	1	10	0
11	0	48	0	11	0
12	0	49	1	12	1
13	0	50	0	13	0
14	1	51	1	14	0
15	0	52	1	15	0
16	0	53	1	16	1
17	1	54	1	17	1
18	1	55**	0	18	1
19	1	56	1	19	1
20	1	57	1	20	0
21	0	58	1	21	1
22	0	59	1	22	0
23	1	60	0	23	0
24	0	61	1	24	1
25	0	62	0	25	1
26	0	63	1	26	0
27	0	64	1	27	1
28	1	65	0	28	1
29	0	66	0	29	1
30	1	67	1	30	0
31	1	68	0	31	1
32	1	69	0	32	1
33	0	70	0	33	0
34	0	71	1	34	0
35	0	72	0	35	1
36	1	73	1	36	0
37	1	74	1	37***	1

NOTES:

* This logic 1 was added to the original (73-bit LPN) sequence.
** This logic 0 was changed from a logic 1 in the original 73-bit LPN sequence.
*** This bit is not inverted in the inverted LPN.

when the terminal loses CCOW acquisition for five minutes in DC mode or for two minutes in AC mode. When frame lock is lost, range lock is also considered lost. When this occurs, the terminal shall inhibit all transmissions, disconnect all user time slots, and reenter frame lock acquisition mode. After frame lock is again acquired: (1) terminals operating in the DC mode shall reconnect user time slots, and (2) terminals operating in the AC mode could request, from the controller, slot connects for the disconnected service.

a. Frame start time in time chips. The start of the frame is at time chip 1, which immediately follows the CCOW preamble. The wraparound from time chip 26624 to time chip 1 occurs within the CCOW time slot, as shown on Figure 6. Time slot duration expressed in time chips of any time slot may be converted to time slot duration expressed as a time value by multiplying the duration of a time chip (1/19200) in seconds by the number of time chips in the time slot. For example, the duration in seconds of the range time slot that begins at time chip 3089 and ends at time chip 4543 (length of 1455 time chips including beginning and ending time chips) is calculated as follows:

(1/19200) x [(4543 - 3089) + 1] = 75.781 ms in duration.

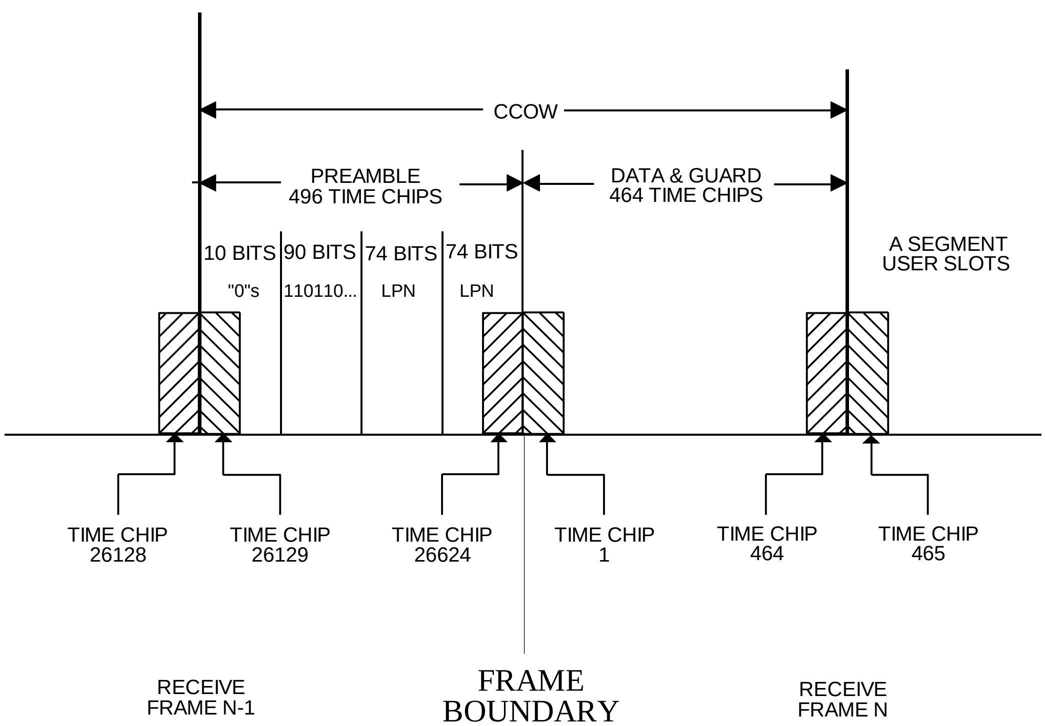


FIGURE 6. Terminal receive timing.

b. Transmit timing. Transmit timing is achieved when the terminal has established receive timing and determined satellite range. The terminal uses its satellite range to adjust its transmit time so its bursts will align in time with the established receive timing. See 5.1.4 for different methods a terminal may use to determine range to the satellite.

c. Time-slot guard time. A terminal shall time all bursts to occur within the allocated times of the time slots specified in 5.1.3.1 through 5.1.3.5. To allow for early or late transmissions resulting from range uncertainty or terminal frequency switching time, or both, the waveform provides (1) guard time at the beginning and end of range, link test, and selected 5-kHz slave channel user time slots (see 5.1.3.3, 5.1.3.4, and 5.1.3.5), and (2) guard time only at the end of the CCOW, RCCOW, and user segment time slots (see 5.1.3.1, 5.1.3.2, and 5.1.3.5). The guard time at the end of a time slot is used as follows: for the guard time assigned at the end of slot *n*, all of the guard time except the last 12 time chips can be used by the terminal transmitting late in the time slot *n*, while the last 12 time chips of the guard time can be used by a terminal transmitting early in the time slot *n* + 1. Paragraph 5.1.4.a defines tolerable range uncertainty and the related terminal transmit requirements. All time slots, except for CCOW, include a minimum guard time allocation of 24 time chips (1250 Fs). To increase the effective guard time to 1750 Fs, the terminal shall either inhibit transmission of the leading zeros (ones for SOQPSK and QPSK I channel) in the preamble for 650 ± 150 Fs (see Figure 5) or transmit bursts which have the first 500 Fs of the preamble removed. As a precaution against transmitting too late, the terminal's transmit-to-transmit switching time shall not exceed 1750 Fsec. Transmit-to-transmit switching time is defined as the time required by the terminal to settle within a steady state of ± 1 dB of required power output and ± 20 hertz (Hz) of set frequency. To ensure adequate reception of adjacent bursts, a terminal's receive-to-receive switching time shall not cause the probability of burst acquisition of the latter burst to degrade below 0.999 in the absence of noise when all guard time between the bursts is depleted due to the first burst being late and the second burst being early. Additionally, in order to provide acceptable burst assignment flexibility for terminals that operate half-duplex (at rf), the terminal's receive-to-transmit switching time shall not exceed 875 Fs and the terminal's transmit-to-receive switching time shall not exceed 875 Fs. Receive-to-transmit switching time is defined consistent with the transmit-to-transmit switching time definition above. Transmit-to-receive switching time will be considered compliant if the end of a transmitted burst is separated from the beginning of a received burst by 875 Fs and the burst acquisition probability for the received burst is at least 0.999 in the absence of noise.

d. **Burst formats**. Each specified time slot within the frame is of sufficient duration to accommodate a single burst comprising preamble, data, and guard time, as specified in 5.1.3.1 through 5.1.3.5, except that multiple bursts per slot are permitted on 5-kHz slave channels as described in 5.1.3.5.2.2.b. The duration of a burst is a function of time slot type, baseband rate, burst rate, FEC coding (see 5.4.1), and fill bits required for FEC flush and completing an interleaver block (see 5.4.2). Burst timing requirements and the component parts of all bursts for all defined time slots shall be as specified in Appendix A.

5.1.3.1 CCOW time-slot timing. CCOW time-slot timing, including guard time allocated at the end of the CCOW time slot, is specified in Table VI. The CCOW time slot is 960 time chips (50.00 ms) in duration with the last 16 time chips (0.833 ms) allocated as guard time. Detailed requirements of the CCOW burst formats are specified in 5.2.1.1 for the AC mode and 5.2.2.1 for the DC mode.

TABLE VI. CCOW, RCCOW, range, and link-test time slots.

TIME SLOT TYPE		START TIME CHIP NUMBER (RECEIVE)	END TIME CHIP NUMBER (RECEIVE)	GUARD TIME AT START OF TIME SLOT (TIME CHIPS)	GUARD TIME AT END OF TIME SLOT (TIME CHIPS)
CCOW		26129	464	0	16
RCCOW	format #1	18253	19125	0	29
	format #2	5837	6710	0	30
RANGE		3089	4543	377	422
LINK TEST		4544	*	60	**

NOTES:
* 5835 for Format number 1 and 5836 for Format number 2.
** Guard time of 693 time chips for a 9.6-ksps burst, 685 time chips for a 19.2-ksps burst, and 683 time chips for a 16-ksps burst. The guard time for even-numbered link-test time slots, when used for ranging, is 577 chips.

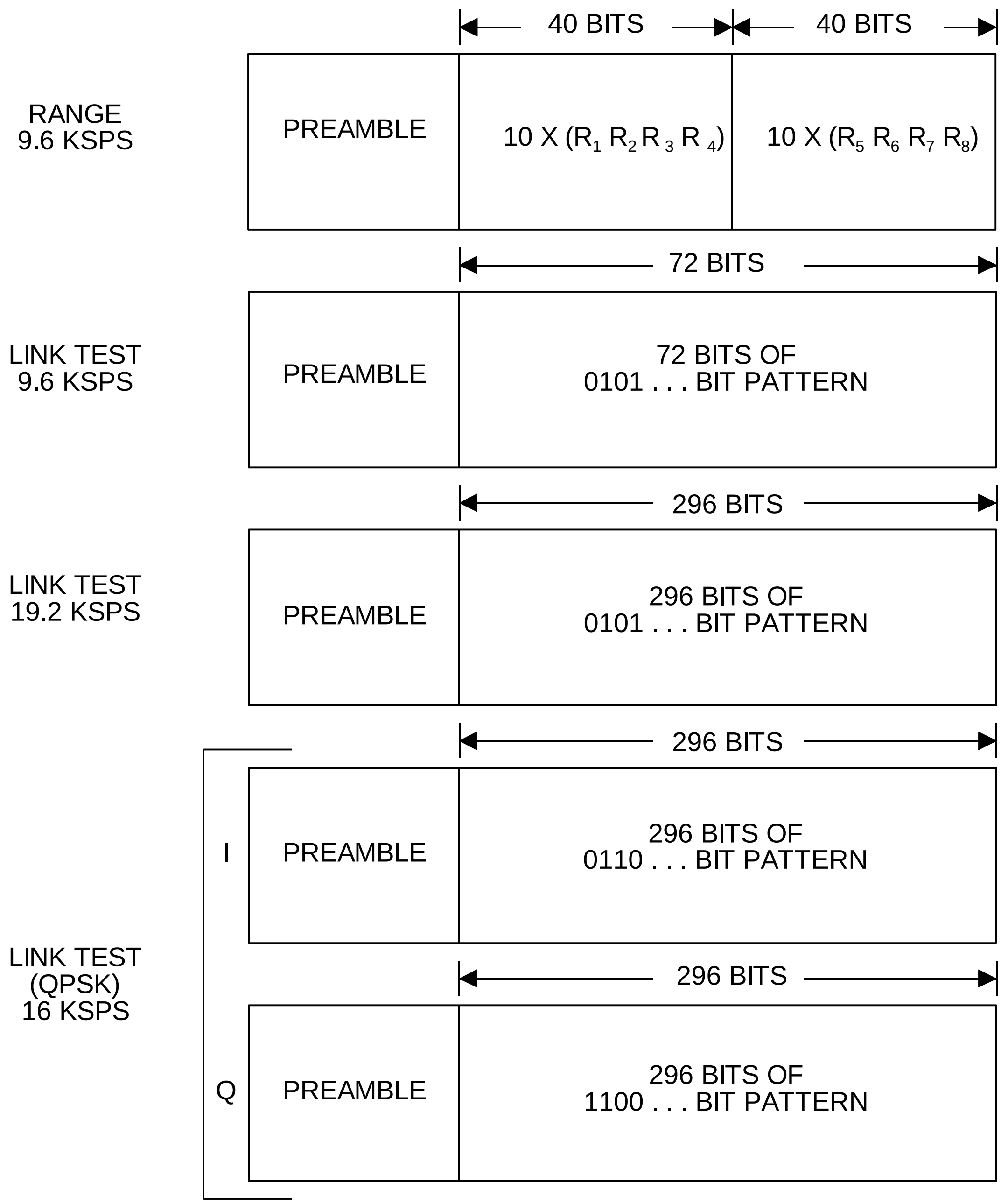
5.1.3.2 RCCOW time-slot timing. RCCOW time-slot timing, including guard time allocated at the end of the RCCOW time slot, shall be as specified in Table VI. Detailed requirements for the burst formats and use of the RCCOW are specified in 5.2.1.2 for the AC mode and 5.2.2.2 for the DC mode. Detailed requirements for RCCOW transmit decisions are specified in 5.2.1.2.3 for the AC mode and 5.2.2.3 for the DC mode.

5.1.3.3 Range time-slot timing and burst formats. Terminals use the range time slot to determine and maintain range to the satellite. The range time slot has sufficient guard time to allow it to be used by terminals with no previous satellite range information. For this reason, the range time slot is used by terminals to establish initial range or reestablish range once a terminal has lost the ability to range successfully in the ELT slot (see 5.1.4.1.1 and 5.1.4.1.2). Range time-slot timing shall be as specified in Table VI. The burst format shall be as shown on Figure 7. The range time slot is 1455 time chips (75.781 ms) in duration, which includes 377 time chips (19.635 ms) of guard time at the beginning of the range time slot and 422 time chips (21.979 ms) of guard time at the end of the range time slot. A terminal shall set its transmit time to ensure that the entire ranging burst occurs within the allocated time of the range time slot as specified in 5.1.3 c. Once range to the satellite has been established, a terminal shall position its range burst within the range time slot so that its transmission avoids overlapping a CCOW reception. Adjustment of terminal transmit timing is required periodically to prevent overlap between adjacent time slots. The terminal shall use a ranging processing method discussed in 5.1.4 to adjust burst time.

5.1.3.4 Link test time-slot timing. Link test time-slot timing shall be as specified in Table VI. The burst format and the pseudorandom data transmitted for each ranging event shall be as shown on Figure 7. The length of the link test time slot is a function of the frame format in use: 67.292 ms (1292 time chips) for format number 1, 67.344 ms (1293 time chips) for format number 2. The length of the guard time at the end of the link test time slot depends on how the slot is being used. In frames where the frame count is odd, the link test time slot is used to perform terminal link quality tests. In the AC mode, a terminal shall initiate a link test only when authorized by a CCOW assignment as specified in 5.2.1.1.2.5. The duration of a link test varies depending on its burst rate, as shown in Table A-I. In even numbered frames (the ELT time slot) the link test time slot can be dedicated to terminals performing active ranging as specified in 5.1.4.1.2. After a terminal determines its range, it should position its range transmission within its dedicated ELT time slot to avoid conflicting at rf with other time slots as much as possible. The terminal shall set its transmit time to ensure that the entire ranging burst occurs within the allocated time of the ELT time slot as specified in 5.1.3 c.

5.1.3.5 User segment time-slot timing.

5.1.3.5.1 User time-slot timing. Figures A-1 through A-4 and Tables A-VI through A-X specify the AC slot number, DC circuit number (25-kHz channels only), time slot start count, time slot end count, and guard time for all user time slots. The time slot start and end counts define the location of each time slot, in time chips, relative to the start of frame (see Figure



NOTE 1 : Values for (R_1 R_2 R_3 R_4) and (R_5 R_6 R_7 R_8) are generated pseudorandomly for each ranging event.

NOTE 2: Preambles for link tests are identical to user preamble Structures.

FIGURE 7. Range and link test burst formats.

6). The guard time defines the number of time chips by which the time slot length exceeds the duration of the specified burst. Guard times are allocated at the end of each burst for 25-kHz channels. Guard times are allocated at the end of each user time slot for both 5-kHz and 25-kHz channels. For selected time slots on 5-kHz slave channels, guard time is also allocated at the beginning of the slot, as noted in Figure A-4. A terminal shall set its transmit time to ensure that the entire burst occurs within the allocated time of the user time slot as specified in 5.1.3 c.

5.1.3.5.2 User time slot burst formats.

5.1.3.5.2.1 25-kHz channel user time slot burst formats. The terminal shall use the modulation rate and FEC code rate as specified in Tables A-II and A-III, and start and end time chip numbers as specified in Tables A-VI through A-X for each burst. The total number of transmitted bits in each burst, excluding preamble bits, represents an integer number of interleaver block pairs (224 bits per block pair). The fill bits specified in the tables are required to fill the last interleaver block and flush the FEC encoder. When a terminal initiates a transmission before sufficient user data has been buffered to fill the first burst, pad bits shall be added preceding the user data to fill the burst. When there are insufficient user data to fill the last burst of a transmission, pad bits shall be inserted between the end of the user data and the beginning of the fill bits to complete the burst. Pad bits shall either be all ones or all zeros.

5.1.3.5.2.2 5-kHz slave channel time slot burst formats. The terminal shall use the modulation rate, FEC code rate, and start and end time chip numbers as specified in Tables A-II through A-V and Figure A-4 for each burst. To meet the specified TDMA throughput delays (see 5.1.3.5.3), the first and last bursts of a transmission are not required to begin or end on time slot boundaries. The First Burst format (see Figure 8) allows the burst to begin at or after the start of the time slot and shall be used for the first burst of any transmission. The Last Burst format allows the burst to end at or before the end of the time slot and shall be used for the last burst of any transmission. The Normal Burst format shall be used for all intermediate bursts. A terminal may use both the First Burst and Last Burst formats in a single short transmission. If there is sufficient time remaining in a time slot following the end of a transmission, a terminal may begin a new transmission in the same time slot. The First Burst, Last Burst, and Normal Burst formats for 5-kHz slave channel time slots are shown in Figure 8.

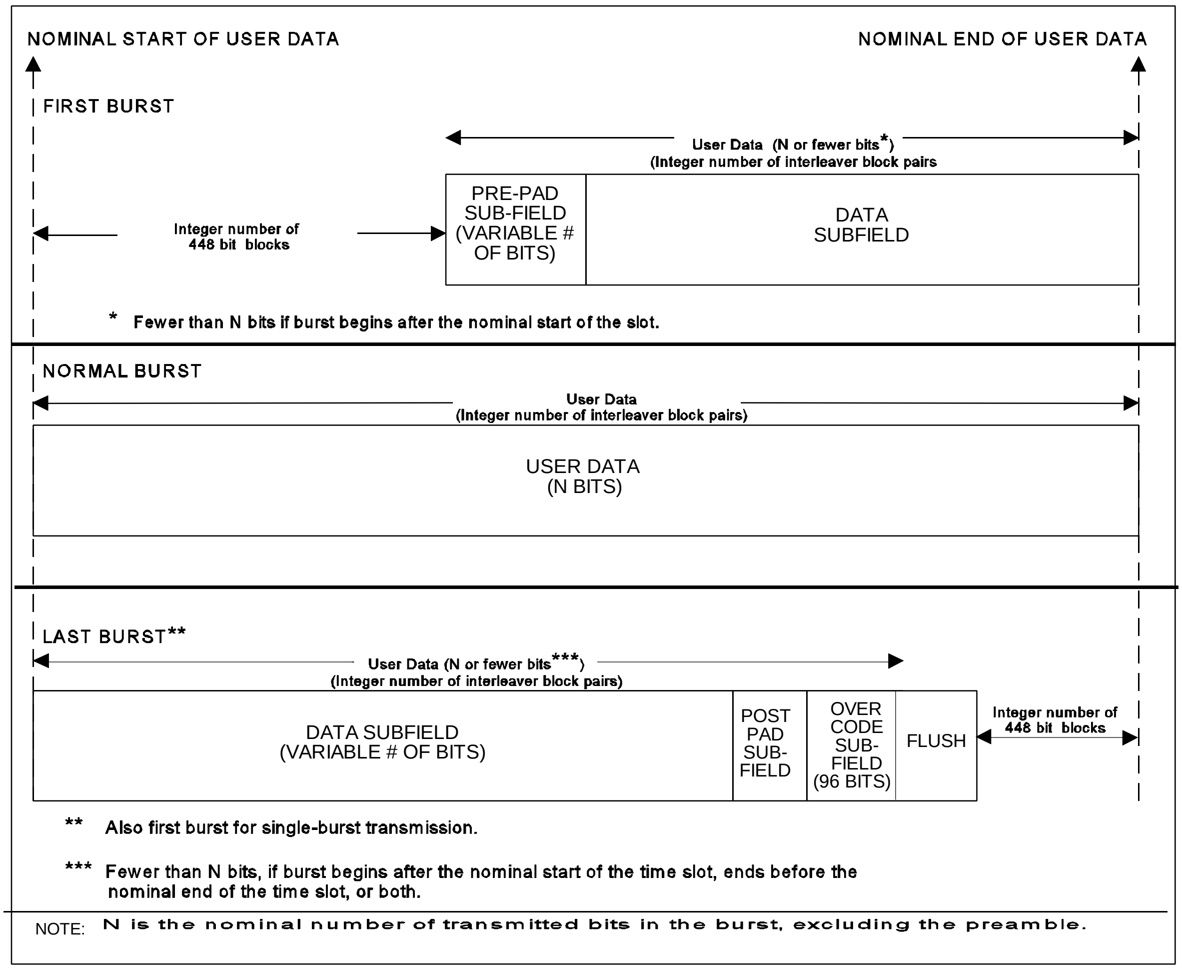


FIGURE 8. Burst formats for 5-kHz slave channels.

a. First burst format. The terminal shall restrict the start time of the first burst of a transmission to designated times within the time slot. These times are measured from the start of the time slot and are repeated at intervals of two interleaver block pairs (448 transmitted bits). When the number of interleaver block pairs contained in a normal burst is not evenly divisible by two, the last designated start time will result in a burst containing only one interleaver block pair. Restricting the start time of the first burst to discrete times allows a receiving terminal to use the time of arrival to locate the end of the burst. When the available user data does not evenly fill the interleaver block pairs used, pad bits shall be added preceding the user data in the first interleaver block pair to fill the burst. Pad bits shall either be all ones or all zeros.

b. Last burst format. Transmission of the last burst can end at any interleaver block pair boundary. To allow a receiving terminal to locate the end of the last burst, the terminal shall place the Over Code sequence at the end of the last interleaver block pair (prior to interleaving) of the transmission. When the Over Code sequence is used, pad bits shall be added between the end of the user data and the start of the Over Code sequence and the fill bits specified in the tables shall not be used. The Over Code sequence consists of the binary value 1111000100110100 (Hex F134) repeated six times, followed by six zeros. The transmission order of the Over Code sequence shall be from left to right. The terminal shall use the same FEC code rate for the Over Code and any added pad bits as defined for the burst. When there is insufficient space following the end of the user data to include the Over Code sequence, pad bits shall be inserted between the end of the user data and the beginning of the fill bits to complete the burst, and a final burst shall be transmitted in the next frame. This final burst shall consist of a single interleaver block pair containing the Over Code sequence at the end of the burst preceded by sufficient pad bits to fill the interleaver block pair. Pad bits shall either be all ones or all zeros. The receiving terminal shall correctly interpret the Over Code pattern if any one of the three 32-bit F134F134 sequence is received error free.

5.1.3.5.3 TDMA throughput delays. Throughput delay is defined as the elapsed time from when a bit enters a terminal I/O port for transmission until the bit is transferred out of a terminal I/O port on the receive end, excluding propagation and COMSEC delay.

5.1.3.5.3.1 25-kHz channel throughput delay. The TDMA throughput delay for 25-kHz control and slave channels shall not exceed the maximum value for each I/O rate as given in Table VII.

5.1.3.5.3.2 5-kHz slave channel throughput delay. The TDMA throughput delay for I/O rates for 300 and 1200 bps shall be as shown in Table VII. The TDMA throughput delays for 2400- and 4800-bps service shall not exceed the maximum values given in Table VIII.

TABLE VII. The Maximum TDMA throughput delays.

I/O RATE (bps)	MAXIMUM THROUGHPUT DELAY (secs) *
75	2.712
300	1.795
600	1.595
1200	1.540
2400	1.512
4800	1.464
16000	1.555

* Does not include round-trip satellite propagation or COMSEC delay.

TABLE VIII. TDMA throughput delay for 5-kHz channels.

BURST RATE (sps)	FEC CODE RATE	MAXIMUM TDMA THROUGHPUT DELAY (seconds)	
		2400-bps VOICE	4800-bps VOICE (optional)
		MAXIMUM DELAY	MAXIMUM DELAY
3000	1/2	.450	N/A
	7/8	.900	N/A
3840	1/2	.690	N/A
	3/4	.950	.400
	7/8	1.050	.550
	1	1.100	.690

NOTE: Delay does not include satellite propagation or COMSEC delay.

5.1.4 Ranging processing. A terminal needs to be able to time the transmission of its bursts such that they are received back at the terminal in the appropriate receive time slot (refer to Table VI and Figure 9). That is, the terminal must compensate for the time it takes for the signal to make the trip to the satellite and back to the terminal. This round-trip time constitutes the terminal's range to the satellite. If a signal is to be received at time *t*, the terminal must transmit that signal at time *t* minus the range in order to compensate for round-trip propagation time and avoid interfering with other time slots. The two primary methods a terminal may use to determine and reestablish its range are called active ranging and passive ranging. Terminals using range and link-test time slots to perform active ranging shall use the algorithms specified in 5.1.4.1.

a. Tolerable range uncertainty. A terminal shall maintain its range uncertainty to less than or equal to 875 Fsec for the duration of its dedicated ranging epoch. If the range uncertainty as determined by any method is less than or equal to 875 μs, the terminal has range lock. If the range uncertainty is greater than 875 μs, the terminal shall inhibit all transmissions except (1) ranging signals and (2) communications bursts in 5-kHz slave channel time slots that have allocated start and end guard times of 367 or more time chips (see 5.1.3.c and Figure A-4). This tolerable range uncertainty value is based on the amount of minimum guard time available at the end of time slots and the minimum transmitter turn on time. Given a minimum guard time of 1.25 ms and a minimum turn on time of 500 μs, the worst-case effective guard time is 1.75 ms. See Figure 9 for an illustration of a time slot with worst-case guard time. For a given terminal, the tolerable range uncertainty is one half of 1.75 ms, or 875 μs. This equates to a tolerable one-way range (called *slant range*) uncertainty of 437.5 μs, or approximately 71 nautical miles (nm).

b. Fast-moving terminals. If the average relative velocity between the satellite and the terminal during a ranging interval is greater than 180 nm per hour (approximately 71 nm divided by 0.3944 hour), the terminal shall use other methods of updating burst transmission time, including, but not limited to, any of those presented below:

1. Range calculations that use satellite position calculated from satellite orbital parameters and platform position on earth, including altitude. This method could use the CCOW discussed in 5.2.1.1.2.20.

2. Range estimates based on extrapolation of differential range changes between active range measurements (assuming heading and average platform speed relative to the satellite remain unchanged).

3. Range estimates based on measurement of average downlink doppler since the last active range measurement.

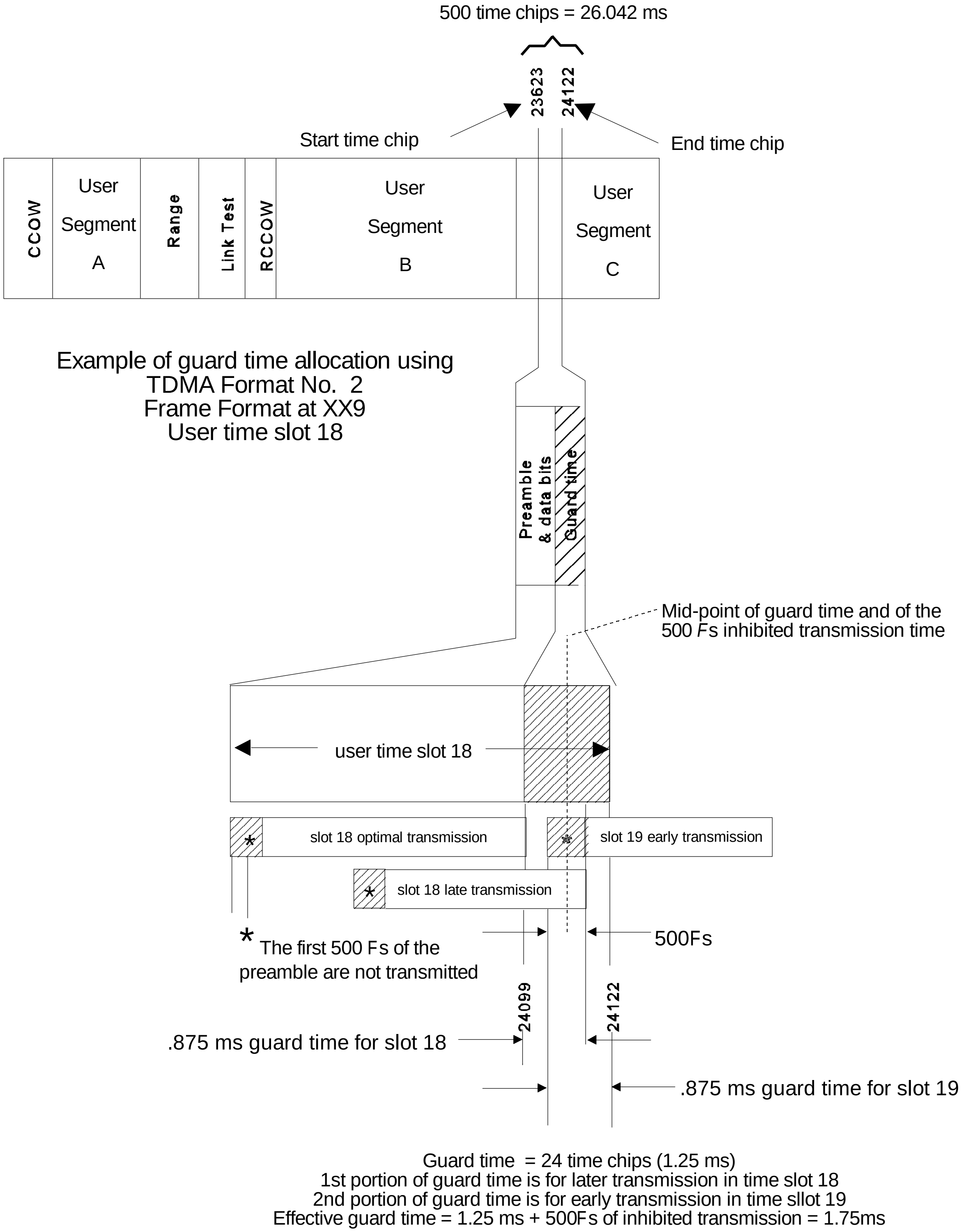


FIGURE 9. User time slot guard time allocation.

4. Active ranging during any user time slot provided that the terminal (1) can receive and decode its own burst, (2) has been assigned the time slot for use, (3) does not interfere with normal transmissions, and (4) does not overlap adjacent slots.

5. Range estimate adjustments based on the difference between the expected time between consecutive CCOW bursts (1.386666 seconds) and the measured time between such bursts. When using this method, it may be assumed that the clock accuracy at the controller will be no worse than 5 parts in 10^8; however, terminal design should accommodate the possibility of a new controller assuming network control with its first CCOW sent with a timing jump (relative to the previous controller’s timing) having magnitude up to 875 Fs.

5.1.4.1 Active ranging. Active ranging is defined as the transmission of a signal to determine range. Two types of active ranging a terminal may use when operating in either the DC or AC mode are random ranging and dedicated ranging. The preamble and number of bits transmitted in each ranging burst shall be as defined on Figures 5 and 7.

5.1.4.1.1 Random ranging. When the frame count is odd, the range time slot is allocated for random access use by all terminals to (1) establish their initial range, (2) reestablish range when a terminal's dedicated ranging attempt is unsuccessful, or (3) range when the ranging attempt in dedicated time slot was unsuccessful due to contention. The advantages of ranging in the range slot are two-fold. First, a terminal can use the range slot at any time to determine or reestablish range quickly, whereas a terminal must wait for at least 1024 frames before it can use the ELT slot (see 5.1.4.1.2). Secondly, the range slot, being longer than the ELT slot, allows the terminal's transmit timing to be less accurate; that is, the receive timing established on the basis of achieving CCOW acquisition is sufficient for a terminal to transmit in the range slot. However, because the range slot in the odd-numbered frames can be used by any and all terminals on a channel, a given terminal's ranging attempt can fail because of contention with the ranging signal from other terminals. To minimize range slot contention, especially on retries, terminals shall perform random ranging as specified in a, below. The terminal shall set its transmit timing for random ranging as described in b and while performing random ranging, shall begin collecting data for dedicated ranging as described in c.

a. Selecting the frame in which to range. After achieving CCOW acquisition, the terminal may transmit an initial ranging burst in a range time slot contained in any following odd-numbered frame. If the first random range measurement is unsuccessful, the terminal shall generate a random number (y) between 1 and 128, wait $2y$ frames, and perform a range measurement using the range time slot in the odd-numbered frame that is 2*y* frames following the unsuccessful measurement. If this range measurement is unsuccessful, the terminal shall wait 256 - 2*y* frames before generating another random number (*y*) and shall repeat the process.

b. Setting the transmit timing for ranging. When in the random range mode with no knowledge of its current range, the terminal shall use a range estimate of 258 ms ± 15 time chips to establish its transmit timing for the ranging signal. The accuracy of all range measurements shall be ± 1 time chip or better.

c. Preparing for dedicated ranging. The terminal shall begin monitoring the ELT slot for activity, maintaining a record of usage for the last 512 ELT slots.

5.1.4.1.2 Dedicated ranging. Dedicated ranging provides some assurance that ranging can be performed without ranging signals from other terminals colliding. A terminal shall only perform dedicated ranging when its range accuracy is within 16.589 ms (one-half of the total ELT slot guard time of 33.177 ms). Terminals on stationary or slow-moving platforms typically are able to maintain range lock for at least 1024 frames (approximately 23.67 minutes). Thus the ranging epoch for these terminals is 1024 frames. Terminals on slow-moving or stationary platforms should perform Method 1 ranging as described in 5.1.4.1.2.1. Terminals on fast-moving platforms, such as aircraft, may need to range more often to maintain the required accuracy (see 5.1.4 b for a discussion of fast-moving terminals). Fast-moving terminals requiring range updates more often than every 23.67 minutes may employ Method 2 ranging as described in 5.1.4.1.2.2. Terminals shall provide a means to disable Method 2 ranging.

5.1.4.1.2.1 Method 1. For terminals configured to operate on lower-speed platforms, the ranging period is every 1024 frames. Terminals required to perform Method 1 ranging shall locate an unused ELT slot to use for dedicated ranging as described in a, below.

a. Locating an available ELT slot. The terminal shall continuously monitor the ELT slots to build a record of ELT time slot use to determine which of the last 512 ELT slots are not being used and, therefore, may be available for this terminal to perform dedicated ranging. Once the terminal has established a record of usage spanning the most recent 512 ELT slots, the terminal shall generate a random number (*x*) between 1 and 64, wait 2*x* frames, and transmit a ranging signal (see Figure 7) in the next unused ELT slot based on the usage information collected over the last 512 ELT slots. The ranging attempt shall be considered successful if the terminal receives its own transmitted ranging pattern with four or fewer errors. If the ranging attempt is successful, the terminal shall range in the link test slot every 1024 frames thereafter. If the ranging attempt fails, the terminal shall repeat its attempt to locate an available ELT slot.

b. Failure of dedicated ranging attempt. If no range transmission is attempted in an ELT slot, or if two consecutive ranging attempts fail, the terminal shall cease transmission in subsequent ELT slots. To continue dedicated ranging, a terminal with a current record of ELT slot usage (covering the most recent 512 ELT slots) shall generate a random number (x) between 1 and 64, wait $2x$ frames, and transmit a ranging signal in the next unused ELT slot. A terminal that has been unable to maintain current usage data (for example half-duplex terminals) shall monitor the ELT slots until it has collected usage data for the last 512 ELT slots before selecting and transmitting another ranging signal in an unused ELT slot. If the ranging attempt is successful, the terminal shall range in the link test slot every 1024 frames thereafter. If the ranging attempt fails, the terminal may repeat the process described in this subparagraph or revert to random ranging.

5.1.4.1.2.2 Method 2. To provide the additional ranging opportunities needed by terminals located on high-speed platforms, the ranging period or epoch is approximately half that of low-speed terminals. Terminals that use Method 2 ranging shall range once in an ELT slot and again in the even range slot 512 frames later, for a ranging epoch interval of approximately 11.8 minutes. It is important to note that Method 2 may still need to be supplemented by measures such as making burst-to-burst time tracking corrections within the ranging epoch interval. Terminals required to perform Method 2 ranging shall locate an unused ELT slot to use for dedicated ranging as described in a, below.

a. Locating an available ELT slot. The terminal shall continuously monitor the ELT slots to build a record of time slot use to determine which of the last 512 ELT slots are not being used and, therefore, may be available for this terminal to perform dedicated ranging. Once the terminal has established a record of usage spanning the most recent 512 ELT slots, the terminal shall generate a random number (x) between 1 and 64, wait $2x$ frames, and select the next unused ELT slot based on the collected usage information. Because Channel Controllers (CCs) range in range time slots in frames with a frame count of $256N + 2$ (for any positive integer N), a terminal shall not range in either the ELT or range slot where the frame count is $256N + 2$. If the frame count for the selected ELT slot is $256N + 2$, the terminal shall select the next unused ELT slot. The ranging attempt shall be considered successful if the terminal receives its own transmitted ranging pattern with four or fewer errors. If the ranging attempt is successful, the terminal shall continue to range in the link test slot every 1024 frames thereafter and alternately in the even-numbered frame range slot 512-frames following the dedicated link test slot. If the ranging attempt fails, the terminal shall repeat its attempt to locate an available ELT slot.

b. Failure of dedicated range attempt. If no range transmission is attempted in an ELT slot, or if two consecutive ranging attempts fail, the terminal shall cease transmission in subsequent ELT and even-numbered range slots. To continue dedicated ranging, a terminal with a current record of ELT slot usage (covering the most recent 512 ELT slots) shall generate a random number (x) between 1 and 64, wait $2x$ frames, and transmit a ranging signal in the next unused ELT slot. A terminal that has been unable to maintain current usage data shall monitor the ELT slots until it has collected usage data for the last 512 ELT slots before selecting and transmitting another ranging signal in a range or ELT slot. As described in a, above, the terminal shall not range in frames where the frame count is $256N + 2$. If the range attempt fails, the terminal may repeat the process described in this subparagraph or revert to random ranging. If the ranging attempt is successful, the terminal shall alternate between the ELT and even-numbered frame range slot to perform subsequent dedicated ranging.

5.1.4.1.3 Assigned ranging. In the AC mode, the CC may send a CCOW:Link Test and Range Frame-Number Assignment message assigning the frame number of the frame which contains the ELT slot the terminal will use for dedicated ranging (see 5.2.1.1.2.5). The terminal shall replace the frame count it is using for ranging with this new value and attempt range as described in 5.1.4.1.2.1 or 5.1.4.1.2.2 in the ELT slot of the next frame in which the lower 10 bits of the frame count (bits 0-9) are equal to the new assigned value. If this CCOW message is received while the terminal is searching for a dedicated range slot (5.1.4.1.2.1 a or 5.1.4.1.2.2 a), the terminal shall abandon the search and use the assigned frame number. The terminal shall update, via this CCOW message, its ELT time slot usage data to indicate frame numbers assigned to other terminals which are unavailable for dedicated ranging. If the terminal is unable to range successfully using the assigned frame number, it shall cease ranging in these frames and attempt to find a new ranging frame as described in 5.1.4.1.2.1 b or 5.1.4.1.2.2 b.

5.1.4.2 Passive ranging. A terminal may also use passive ranging to adjust its transmit timing. Passive ranging measures do not require the terminal to transmit. For example, the terminal may use ephemeris data or frame timing to determine its range. Other methods are listed in 5.1.4 b.

5.2 Orderwire protocols and structure. Field locations and length in bits for the CCOW and RCCOW bursts for both AC and DC operating modes shall be as specified in Appendixes B and C, respectively. Each orderwire message (CCOW and RCCOW) shall be composed of thirteen 8-bit bytes. Most of the orderwire messages contain fields marked as not used or noted as spare. Except for calculating CRC, terminals shall ignore these fields.

5.2.1 AC mode orderwire protocols and structure. The fields for each AC mode CCOW and RCCOW message are defined in 5.2.1.1 and 5.2.1.2, respectively.

5.2.1.1 CCOW in the AC mode. Fields common to all CCOWs, and terminal actions required upon receipt, are discussed in 5.2.1.1.1. Fields unique to each CCOW message, and terminal actions required upon receipt, are discussed in 5.2.1.1.2.

5.2.1.1.1 Common CCOW fields. With the exception of the CCOW:Master Frame message, every CCOW message contains six common fields. The master frame, which does not contain a Command field, contains five common fields. The terminal shall be capable of receiving and processing the common fields in every CCOW message listed in Table IX. The terminal shall comply with the CCOW command in the frame following receipt of the CCOW. These fields are described below:

TABLE IX. AC mode CCOW messages and Command field codes.

COMMAND FIELD CODE	CCOW MESSAGE
None	Master Frame
00000	No Command
00001	Slot Disconnect
00010	Slot Connect
00011	Link Test and Range Frame-Number Assignment
00100	Channel Control Handover Request
00101	Special Format Change Order
00110	Call Canceled
00111	TDMA Channel Reassignment
01000	Enter Guard List
01001	Delete from Guard List
01010	Call Waiting
01011	Call in Queue
01100	Computer Data Transfer
01101	Information Request
01110	Zeroize
01111	Time-Slot Preparation
10000	Requested Party Out-of-Service
10001	Transmit Control
10010	Satellite Ephemeris Data
10011-10100	Spare
10101	DASA Channel Assignment
10110-11111	Spare

a. CALL ACK field (Bits 0-2, byte 1). The CC sets the CALL ACK field, as defined in Table X, to acknowledge receipt of RCCOW messages. The acknowledgment applies to the RCCOW message sent three frames earlier by the terminal I/O port identified by the address in the User Number field. Terminals shall use this field to determine if the CC received the RCCOW. The terminal requires acknowledgment for an RCCOW it transmits in a non-dedicated RCCOW time slot or in a dedicated RCCOW time slot in response to the Conference Party List or Status Report A RCCOW Assignment codes. The terminal also requires acknowledgment of any unsolicited RCCOW it transmits in a dedicated time slot. The CC is not required to acknowledge RCCOWs transmitted in dedicated RCCOW time slots in response to RCCOW Assignment codes other than the Conference Party List or Status Report A. See 5.2.1.2.3 for description of RCCOW retransmit protocols.

TABLE X. AC mode CALL ACK field definitions.

FIELD DEFINITION	CODE	DEFINITION
No Acknowledgment	000	CC has not received an error-free RCCOW to be acknowledged.
Spare	001	
Busy	010	CC has received an error-free RCCOW but will not process this RCCOW (such as when CC queues are full).
Call in Queue	011	CC has received an error-free RCCOW and has placed it in queue for processing. The CC returns this code in response to RCCOWs for which the originating terminal is awaiting further CC processing (such as time-slot assignment).
Out-of-Service	100	CC has received an error-free RCCOW:Out-of-Service message from the originator.
Call Acknowledge	101	CC has received an error-free RCCOW and will process it. The CC returns this code in response to RCCOWs for which the originating terminal is not awaiting further CC processing (such as an RCCOW:Call Complete message)
Spare	110	
Spare	111	

b. RCCOW Assignment field (Bits 3-7, byte 1). The CC sets the RCCOW Assignment field, as defined in Table XI, to identify how the terminal(s) identified in the User Number field are to use the RCCOW time slot in the subsequent frame(s). Terminals shall interpret any codes not defined (spare) at time of terminal construction as a command to inhibit RCCOW transmission in the next frame. Terminal interpretation of these codes shall be as follows:

1. RCCOW Precedence (Codes 00001, 00010, 00011, 00100, 00101). Specifies the minimum precedence an RCCOW must have to be transmitted in the next frame. The terminal shall not transmit an RCCOW with lower precedence.

2. Conference Party List (Code 00110). Specifies that the terminal transmit the RCCOW:Conference Party List message for the I/O port specified in the User Number field.

3. Dedicated RCCOW (Code 00111). Specifies that the RCCOW time slot in the next frame has been reserved for the exclusive use of the terminal identified by the address in the User Number field.

4. Spare (Code 01000).

TABLE XI. AC mode RCCOW Assignment field definition.

CODE	FIELD DEFINITION
00000	Invalid
00001	RCCOW Precedence Flash Override
00010	RCCOW Precedence Flash
00011	RCCOW Precedence Immediate
00100	RCCOW Precedence Priority
00101	RCCOW Precedence Routine
00110	Conference Party List
00111	Dedicated RCCOW
01000	Spare
01001	Status Report A: Group 1
01010	Status Report B: Group 1
01011	Report Link Test Results
01100	Guard List Report: Group 1
01101	Guard List Report: Group 2
01110	Guard List Report: Group 3
01111	Guard List Report: Group 4
10000	Inhibit RCCOW
10001	Status Report A: Group 2
10010	Status Report B: Group 2
10011	Guard List Report: Group 5
10100-11111	Spare

5. Status Report A: Group 1 (Code 01001). Specifies that the terminal whose terminal base address matches the address in the User Number field shall transmit a RCCOW:Status Report A message in the next frame. This report is used by terminals to inform the CC of its communications capabilities and to report the connection status of its first through fourth I/O ports, or as equipped if less than four.

6. Status Report A: Group 2 (Code 10001). Specifies that the terminal whose terminal base address matches the address in the User Number field shall transmit a RCCOW:Status Report A message in the next frame. This report is used by terminals to inform the CC of its communications capabilities and to report the connection status of its fifth through eighth I/O ports. This report is only used by terminals with more than four I/O ports.

7. Status Report B: Group 1 (Code 01010). The CC uses this code to solicit status information from the first through fourth I/O ports of a terminal. This RCCOW specifies that the terminal transmit a RCCOW:Status Report B message in the next frame for the I/O port specified in the User Number field. The terminal shall report the status information for the specified I/O port in those RCCOW message fields that apply only to a single port (Port Configuration Code, Port Configuration Change Flag, Port Bit Rate). For those message fields that apply to the group of ports (Port #n Number in Guard List, Port #n Guard List Change Flag) the terminal shall report the status information for I/O ports 1 through 4 as described in 5.2.1.2.2.1.

8. Status Report B: Group 2 (Code 10010). The CC uses this code to solicit status information from the fifth through eighth I/O ports of a terminal. This RCCOW specifies that the terminal transmit a RCCOW:Status Report B message in the next frame for the I/O port specified in the User Number field. The terminal shall report the status information for the specified I/O port in those RCCOW message fields that apply only to a single port (Port Configuration Code, Port Configuration Change Flag, Port Bit Rate). For those message fields that apply to the group of ports (Port #n Number in Guard List, Port #n Guard List Change Flag) the terminal shall report the status information for I/O ports 5 through 8 as described in 5.2.1.2.2.1.

9. Report Link Test Results (Code 01011). Specifies that the terminal whose terminal base address matches the address in the User Number field shall transmit an RCCOW:C/N_o and Link Test Results message in the next frame.

10. Guard List Report: Group 1 (Code 01100). Specifies that the terminal whose terminal base address matches the address in the User Number field shall report the first group of addresses in its guard list via an RCCOW:Guard List Report message in the next frame.

11. Guard List Report: Group 2 (Code 01101). Specifies that the terminal whose terminal base address matches the address in the User Number field shall report the second group of addresses in its guard list via an RCCOW:Guard List Report message in the next frame.

12. Guard List Report: Group 3 (Code 01110). Specifies that the terminal whose terminal base address matches the address in the User Number field shall report the third group of addresses in its guard list via an RCCOW:Guard List Report message in the next frame.

13. Guard List Report: Group 4 (Code 01111). Specifies that the terminal whose terminal base address matches the address in the User Number field shall report the fourth group of addresses in its guard list via an RCCOW:Guard List Report message in the next frame.

14. Guard List Report: Group 5 (Code 10011). Specifies that the terminal whose terminal base address matches the address in the User Number field shall report the fifth group of addresses in its guard list via an RCCOW:Guard List Report message in the next frame.

15. Inhibit RCCOW (Code 10000). Specifies that all terminals shall inhibit transmission of any RCCOW in the next frame.

16. Spare (Codes 10100 through 11111).

c. User Number field (Bits 0-5 and 7, byte 2; bits 0-7, byte 3; and bit 5, byte 7). This field can identify the terminal base or I/O port address to which the next frame's RCCOW time slot is assigned or the terminal base or I/O port address for which the CALL ACK applies. The interpretation of this field is based on the settings in the CALL ACK and RCCOW Assignment fields (see Section 6, Table XXXI). When the CALL ACK field contains binary zero and the RCCOW Assignment field contains the code for the Inhibit RCCOW {code 10000, described in 5.2.1.1.1 b (15)} or one of the five RCCOW Precedence codes {codes 00001-00101, described in 5.2.1.1.1 b (1)}, the User Number field will be set to binary zero. These 6 RCCOW assignments apply to all terminals. When the CALL ACK field contains binary zero and the RCCOW Assignment field code is not one of the 6 identified above, the User Number field identifies the terminal base or I/O port address to which the next frame's RCCOW time slot is assigned. When the CALL ACK field contains a non-zero value, the User Number field identifies the I/O port address for which the CALL ACK applies. The CCOW:Master Frame message provides space for only a 15-bit User Number field. All terminals with 16-bit addresses shall assume the MSB (bit 16) is a zero when receiving the CCOW:Master Frame message. Terminals with terminal base addresses containing a one as the MSB (bit 16) cannot receive an RCCOW assignment or CALL ACK in CCOW:Master Frame messages. These terminals shall not transmit RCCOWs which would require the CC to respond with a CALL ACK in CCOW:Master Frame messages. User number bit 15 is contained in bit 5 of byte 7 in all but two CCOW messages. For a CCOW:Master Frame message, bit 15 is contained in bit 6 of byte 8 and in the CCOW:Computer Data Transfer message bit 15 is contained in bit 7 of byte 4.

d. Flag field (Bit 6, byte 2). This flag is set to binary 1 to identify the frame as a master frame. The flag is set to binary 0 in all other frames.

e. Parity field (Bits 0-7, byte 5 and bits 0-7, byte 6). This field defines the 2-byte CRC derived as specified in 5.4.3.

f. Command field (Bits 0-4, byte 7). When the Flag field is set to binary 0, this field identifies which CCOW message~~s~~ is contained in this frame. When the Flag field is set to binary 1, this frame contains a CCOW:Master Frame message which does not contain a Command field. The CCOW messages and associated codes are listed in Table IX.

5.2.1.1.2 Unique CCOW message fields. The fields unique to each CCOW message are defined in 5.2.1.1.2.1 through 5.2.1.1.2.20. The terminal shall process each CCOW message to determine whether the message is directed to it. A CCOW message is directed to a terminal when: (1) it is directed to all terminals or (2) the terminal’s I/O port or guard addresses is in the User ID or Called Party field of the CCOW, depending on CCOW content. Each terminal shall initiate actions as defined within the CCOW messages directed to it.

5.2.1.1.2.1 Master Frame (Figure B-1) (Command Field Code NONE). This CCOW message is transmitted every eighth frame to update the frame configuration and to provide orderwire and key generator (KG) status. The terminal shall interpret the data fields in this CCOW as follows:

a. Precedence Cutoff (Bit 7, byte 2 and bits 0-1, byte 7). This field identifies the minimum precedence the CC anticipates sending in the RCCOW Assignment field for the next seven frames. Valid precedence cutoff values are as shown in Table XII. The precedence cutoff value should be displayed at the terminal for operator use.

TABLE XII. Precedence Cutoff field definitions.

CODE	FIELD DEFINITION
000	Spare
001	Emergency Action
010	Flash Override
011	Flash
100	Immediate
101	Priority
110	Routine
111	Spare

b. Frame Format (Bits 0-7, byte 4 and bits 2-5, byte 7). This non-contiguous 12-bit field is subdivided into three 4-bit subfields containing hexadecimal (HEX) subformat indicators to be used on each of the three user segments. If the received frame format results in a format number change (see 5.1.1.1 a), the terminal shall disconnect all slot connections, cancel all special format change orders, and starting in the next frame begin using the received frame format. If the received frame format does not result in a format number change, starting in the next frame the terminal shall begin using the received frame subformats on each user segment that is not operating under a special frame format change order. The terminal shall disconnect all slot connections from user segments whose subformat indicator was changed as a result of this action. For example, consider that a terminal is operating with a frame format of 359 with its user segment B operating under a special frame format change order. If the frame format is changed to 249, a terminal would change its frame format to 259 and disconnect all slot connections from user segment A. in changed subformat segments will be disconnected.

c. KG Memory (Bits 6-7, byte 7 and bit 7, byte 8). This field identifies the KG memory location in use.

d. KG Net Number (Bits 0-4, byte 8). This field identifies the KG Net Number in use.

e. KG Day (Bits 5-7, byte 9). This field identifies the KG Day of the week.

f. Frame Count (Bits 0-4, byte 9; bits 0-7, byte 10; and bits 0-7, byte 11). This field identifies the frame count of the current frame.

g. DC Flag (Bit 5, byte 8). This flag identifies whether the channel is operating in the AC or DC mode. If the flag is set to binary 0, the channel operates in the AC mode. If the flag is set to binary 1, the channel operates in the DC mode.

h. Scrambled CC KG ID (Bits 0-7, byte 12 and bits 0-7, byte 13). When the orderwire is encrypted, this field contains the scrambled CC KG ID number that was used to encrypt the CCOW (see 5.3.2.1 and 5.3.2.2). When the orderwire is not encrypted, this field contains the CC terminal base address.

5.2.1.1.2.2 No Command (Figure B-2) (Command Field code 00000). The CC sends this CCOW when there is no other CCOW message to be sent in the frame. The terminal shall interpet the Controller Address field (bits 0-7, byte 8 and bits 0-7 byte 9) as the address of the active channel controller (the terminal transmitting the CCOWs) for this channel. The terminal should display this field so that the operator may address traffic to the controller.

5.2.1.1.2.3 Slot Disconnect (Figure B-3) (Command Field Code 00001). This CCOW message directs terminals to disconnect selected I/O ports from user segment time slots. Three methods are available for directing I/O port disconnects. All combinations of these three methods are allowable. The three methods are:

! The disconnect can be directed to all I/O ports connected to a designated time slot. All I/O ports supporting a non-frequency switched connection to a time slot identified in the Slot Number field shall be disconnected from that time slot prior to the next frame. Since this CCOW does not contain a Channel Frequency Code field, disconnect of frequency switched connections by slot number is not supported.

! The disconnect can be directed to one or all I/O ports of terminals identified in either or both of the User ID fields. Terminal I/O ports identified in either of the User ID fields will be disconnected from their time slot based on setting of the All Ports Flag and Time field. An All Ports flag and a Time field are associated with each User ID field. If the corresponding All Ports flag is set to binary 0, only the I/O port identified in the User ID field shall be disconnected. If the corresponding All Ports flag is set to binary 1, all I/O ports of the terminal identified in the User ID field shall be disconnected. If the corresponding Time field is set to a binary 0, the disconnects shall occur prior to the next frame. If the corresponding Time field is set to a non-zero value, the disconnects shall occur in the frame following expiration of the time specified.

! The disconnect can be directed to one or two guard addresses. A terminal I/O port shall disconnect from a time slot if (1) the I/O port is guarding the address specified in either of the two User ID fields, and (2) the I/O port is currently connected to the time slot based on the specified guard address. Terminal I/O ports will be disconnected based on the setting of the Time field. If the corresponding Time field is set to binary 0, the disconnects shall occur prior to the next frame. If the Time field is set to a non-zero value, the disconnects shall occur in the frame following expiration of the time specified. The All Ports flag is not applicable when a guard address is included in the User ID field.

The terminal shall remove from queue all RCCOW:Call Complete messages originated by I/O ports which are disconnected by this CCOW. The terminal shall interpret the data fields in this CCOW and initiate actions as follows:

a. Slot Number (Bits 0-4, byte 4). This field identifies a time slot from which I/O ports are to be disconnected. Valid slot numbers range from 1 to 23, depending on the frame format in use. This field is set to binary 0 when a disconnect from a designated slot number is not being directed.

b. User #1 ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies an I/O port or guard address being directed to disconnect from a control or slave channel time slot. This field is set to binary 0 when no address is being directed to disconnect.

c. User #2 ID (Bits 6-7, byte 7; bits 0-5, byte 10; and bits 0-7, byte 11). This field identifies a second I/O port or guard address being directed to disconnect from a control or slave channel time slot. This field is set to binary 0 when there is no second address being directed to disconnect.

d. User #1 All Ports Flag (Bit 7, byte 10). This flag, when set to binary 1, directs all I/O ports of the terminal identified by the User #1 ID field be disconnected from their time slots. This flag is set to binary 0 when only the I/O port identified by the address in the User #1 ID field is to be disconnected or when no address is being directed to disconnect.

e. User #2 All Ports Flag (Bit 6, byte 10). This flag, when set to binary 1, directs all I/O ports of the terminal identified by the User #2 ID field be disconnected from their time slots. This flag is set to binary 0 when only the I/O port identified by the address in the User #2 ID field is to be disconnected or when no second address is being directed to disconnect.

f. Time #1 (Bits 0-7, byte 12). This field identifies the time remaining before the I/O port(s) identified in the User #1 field are to be disconnected. This field is composed of a 6-bit time subfield (bits 0-5) and a 2-bit time unit code subfield (bits 6-7). The 6-bit time subfield values represent units of time from 0 to 59. The 2-bit time unit code identifies whether the time defined in the first 6 bits is in units of seconds, minutes, hours, or days, as listed in Table XIII. This field is set to binary 0 to direct disconnect prior to the next frame or when no address is being directed to disconnect.

g. Time #2 (Bits 0-7, byte 13). This field directs the same terminal action for the I/O port(s) identified by the address in the User #2 ID field as described for the Time #1 field.

TABLE XIII. Time subfield values.

BIT		UNIT OF TIME
7	**6**	
0	0	Seconds
0	1	Minutes
1	0	Hours
1	1	Days

5.2.1.1.2.4 Slot Connect (Figure B-4) (Command Field Code 00010). This CCOW directs terminals identified in the User ID fields to connect one of their I/O ports to the user segment time slot identified in the Slot Number field.

! When the specified I/O port is not connected to a time slot it shall connect to the time slot specified in the Slot Number field on the channel indicated in the Channel Frequency Code field. Terminals shall use the Channel Frequency Code field to determine if the slot connect command applies to a 5- or 25-kHz channel. If the slot connect contains a specified time in the Time field, terminals participating in the service shall automatically disconnect at the expiration of that time. If the corresponding Receive-Only flag is set to 1, the connected I/O port shall not transmit in this time slot.

! When the specified I/O port is already connected to the communications time slot specified in the Slot Number field on the channel indicated by the Channel Frequency Code field, the terminal shall update the I/O port connect time and transmit/receive status based on the values received in the Time field and the User #1 Receive-Only flag or User #2 Receive-Only flag fields.

! When the specified I/O port is already connected to a communications time slot different than that specified in the Slot Number field or on a different channel than indicated by the Channel Frequency Code field, the terminal shall ignore the CCOW:Slot Connect message.

The terminal shall interpret the fields in this CCOW as follows:

a. Bit Rate (Bits 5-7, Byte 4). When the CCOW is directed to a 25-kHz channel, this field indicates the bit rate associated with the time slot indentified in the Slot Number field. When directed to a 5-kHz channel, this field is set to binary zero.

Processing of this field is optional. The corresponding bit rates are listed in Table XIV.

TABLE XIV. Bit Rate field definitions.

CODE	BIT RATE (bps)
000	75
001	300
010	600
011	1,200
100	2,400
101	4,800
110	16,000
111	Spare

b. Slot Number (Bits 0-4, byte 4). This field identifies the time slot to which the terminal I/O port is to be connected. Slot numbers for time slots on 25-kHz control and slave channels range from 1 to 23, depending on the frame format in use (see Figures A-1 through A-3). Slot numbers for time slots on 5-kHz slave channels range from 1 to 28 (see Figure A-4).

c. User #1 ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies an I/O port or guard address being directed to connect to a time slot.

d. User #2 ID (Bits 6-7, byte 7; bits 0-5, byte 10; and bits 0-7, byte 11). This field identifies another I/O port or guard address being directed to connect to a time slot. This field is set to binary 0 if there is only one address being directed to perform a slot connect.

e. User #1 Receive-Only Flag (Bit 7, byte 10). This flag, when set to binary 1, restricts the I/O port identified by the address in the User #1 ID field to receive-only communications.

f. User #2 Receive-Only Flag (Bit 6, byte 10). This flag, when set to binary 1, restricts the I/O port identified by the address in the User #2 ID field to receive-only communications.

g. Time (Bits 0-7, byte 12). This field is composed of a 6-bit time subfield (bits 0-5) and a 2-bit time unit code subfield (bits 6-7) defined in 5.2.1.1.2.3 f. Binary 0 in this field indicates that the I/O port identified by either the User #1 or #2 ID field has an unlimited time slot assignment time. If the Time field is nonzero, the I/O ports identified by the User #1 or #2 ID fields are connected for the defined time period.

h. Channel Frequency Code (Bits 0-7, byte 13). This field identifies the channel frequency code for the slot connect. The uplink and downlink frequencies corresponding to the channel frequency code are shown in Table D-I.

5.2.1.1.2.5 Link Test and Range Frame-Number Assignment (Figure B-5) (Command Field Code 00011). This CCOW message directs a terminal to perform one of three mutually exclusive actions: initiate a link test, terminate a link test, or change the frame count used for dedicated ranging.

! If the Dedicated Range Frame-Number field is set to binary zero, the terminal identified in the User ID field initiates or terminates a link test based on the value of the T flag. If the T flag is set to binary 1, the terminal identified in the User ID field shall terminate its link test and save the results of the link test up to the point of test termination. If the T flag is set to binary 0, the terminal shall transmit a predetermined test pattern in every odd-numbered Link Test time slot, beginning in the next odd-numbered frame. The terminal shall transmit a test pattern at the burst rate indicated by one of the flags discussed in c, d, or e, below. One and only one of the flags will be set by the CC when assigning a terminal to conduct a link test. Figure 7 specifies the test pattern to be transmitted for each burst rate. The number of bursts for each link test is specified in Table A-I. The terminal shall measure C/N_o for the link test bursts and for CCOWs received over the course of the link test and shall report the results of the link test as described in 5.2.1.2.2.9.

! If the Dedicated Range Frame-Number field contains a value other than binary 0, the terminal identified in the User ID field shall change the frame count used for dedicated ranging. The terminal shall range in the next ELT slot in which the lower 10 bits of the frame count are equal to the 10 bits received in the Dedicated Range Frame-Number field, then every 1024 frames thereafter. Terminals performing Method 2 ranging shall also range in the even-numbered range slots as specified in 5.1.4.1.2.2. The terminal shall continue to range as specified in 5.1.4.1.2 and 5.1.4.1.3.

The terminal shall interpret the data fields in this CCOW as follows:

a. User ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the terminal base address of the terminal being directed to initiate or terminate a link test or being issued a ranging assignment.

b. T Flag (Bit 0, byte 11). This flag, when set to binary 1, directs that an ongoing terminal link test be terminated. This flag is set to binary 0 when this CCOW message is used to initiate a link test or assign a frame number for dedicated ranging.

c. 9.6-ksps Flag A (Bit 0, byte 4). This flag, when set to binary 1, directs the terminal to perform the link test at 9.6 ksps. This flag is set to binary 0 if the CCOW assigns a ranging frame number, terminates a link test, or if one of the flags described in d or e, below, is set to binary 1.

d. 19.2-ksps Flag B (Bit 1, byte 4). This flag, when set to binary 1, directs the terminal to perform a link test at 19.2 ksps. This flag is set to binary 0 if the CCOW assigns a ranging frame number, terminates a link test, or if one of the flags discussed in c or e is set to binary 1.

e. 16-ksps Flag C (Bit 2, byte 4). This flag, when set to binary 1, directs the terminal to perform a link test at 16 ksps. This flag is set to binary 0 if the CCOW assigns a ranging frame number, terminates a link test, or if one of the flags discussed in c or d, above, is set to binary 1.

f. Dedicated Range Frame-Number (Bits 0-1, byte 12 and bits 0-7, byte 13). This field, if set to a non-zero value, identifies the frame count of the ELT slot that the terminal will use to perform dedicated ranging. The LSB in this field will always be set to binary 0 to ensure ranging is performed in even-numbered frames. This field is set to binary 0 when the CCOW directs or terminates a link test.

5.2.1.1.2.6 Channel Control Handover Request (Figure B-6) (Command Field Code 00100). This CCOW is sent by a CC to another CC to coordinate the transfer of channel control responsibilities. The data fields in this CCOW will be defined in the CC system specification.

5.2.1.1.2.7 Special Format Change Order (Figure B-7) (Command Field Code 00101). This CCOW message directs terminals identified in either of the User ID fields, or all terminals on the channel, to change the frame format being used. The terminals shall interpret this message in one of two ways depending on the setting of the All-User flag.

! When the All-User flag is set to binary 0, starting in the next frame, terminals identified in either of the User ID fields shall commence, update, or terminate operation under a special format change order. Each frame format segment shall operate under a special format change order when directed by this CCOW message to a frame subformat that when differs from the frame subformat specified for the channel (as specified by the most recent master frame or CCOW:Special Format Change Order message with the All-User flag set to binary 1). Terminals shall continue to operate using a frame subformat under a special format change order until (1) another CCOW:Special Format Change Order message is received that directs the frame subformat be the same as specified for the home channel, or (2) the received frame format results in a format number change (see 5.1.1.1 a). When Format number 1 is in use on a channel, the controller will not command a terminal on the channel to operate under a special format change order. The primary purpose of the special format change order is to setup a terminal prior to directing it to make a frequency switched connection to a time slot on a channel operating with a different frame format.

! When the All-User flag is set to binary 1, this command is directed to all terminals and changes the frame format specified for the channel. The purpose of the All-User flag is to cause an immediate change to the frame format without the necessity of of waiting for the next master frame. The terminal shall handle this frame format change command the same as if received in a master frame (see 5.2.1.1.2.1 b)

If a terminal changes its frame format, all slot connections located in user segments with changed frame subformats shall be disconnected. When the format changes from Format number 2 to Format number 1, the terminal shall disconnect all slot connections in all user segments and cancel any special format change order in effect. All changes shall take place at the start of the next frame. The terminal shall interpret the data fields in this CCOW as follows:

a. User #1 ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the terminal base address or a guard address. Terminals identified by this address are directed to change their frame format to that specified in the Format #1 field. This field will be set to zero when the All-User flag is set to a binary 1.

b. User #2 ID (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies the terminal base address or a guard address. Terminals identified by this terminal base address are directed to change their frame format to that specified in the Format #2 field. This field will be set to binary zero when only one terminal or guard group is being directed to change frame format or if the All-User flag is set to a binary 1.

c. All-User Flag (Bit 7, byte 7). This flag, when set to binary 1, directs this CCOW message to all terminals. The new frame format is specified in the Format #1 field and repeated in the Format #2 field.

d. Format #1 (Bits 4-7, byte 4 and bits 0-7, byte 12). This field identifies the new frame format to be used by the terminals identified by the address in the User #1 ID field or if the All-User flag is set to binary 1 by all terminals on the channel. This field defines the subformat to be used on each of the user segments (4 bits designated for each user segment). See 5.1.1.1 and 5.2.1.1.2.1 b.

e. Format #2 (Bits 0-3, byte 4 and bits 0-7, byte 13). This field identifies the new frame format to be used by the terminals identified by the address in the User #2 ID field or if the All-User flag is set to binary 1 by all terminals on the channel. This field defines the subformat to be used on each user segment (4 bits for each segment). This field is set to binary zero when only one terminal or guard address group is being directed to change its frame format. See 5.1.1.1 and 5.2.1.1.2.1 b.

5.2.1.1.2.8 Call Canceled (Figure B-8) (Command Field Code 00110). This CCOW message notifies up to three terminal I/O ports that their call requests have been canceled by the CC. The terminal specification should define terminal actions, including notification of the operator, upon receipt of this CCOW. The terminal shall interpret the data fields in this CCOW as follows:

a. User #1 ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies an I/O port address. Terminals are advised that the call request initiated by the I/O port identified by this address has been cancelled.

b. User #2 ID (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies another I/O port address and advises terminals identified by this address as described for the User #1 ID field. This field is set to binary 0 when only one address is being advised of call cancellation.

c. User #3 ID (Bits 0-7, byte 12 and bits 0-7, byte 13). This field identifies another I/O port address and advises terminals identified by this address as described for the User #1 ID field. This field will be set to binary 0 when only one or two addresses are being advised of call cancellation.

5.2.1.1.2.9 Channel assignment. This waveform includes provisions for terminals to be switched automatically from one satellite channel to another. This is performed upon terminal request (see 6.4) or as determined by the CC during satellite resource allocation. Channel assignment shall be performed as specified in 5.2.1.1.2.9.1 and 5.2.1.1.2.9.2.

5.2.1.1.2.9.1 TDMA Channel Reassignment (Figure B-9) (Command Field Code 00111). This CCOW message directs any combination of up to three terminals or guard addresses, or all terminals on the channel, to move to the home channel identified in the Channel Frequency Code field. If any of the three User ID fields contain the terminal's base address, an address guarded by the terminal, or if the All Change Flag is set to binary 1; the terminal shall terminate all orderwire activity on its current home channel and attempt to acquire the new channel specified in the Channel Frequency Code field. If unable to acquire the new home channel within 90 seconds, the terminal shall return to its previous home channel. Upon such return, the terminal shall retain its established dedicated ranging and user time slots if (1) it has not missed a ranging opportunity since it initiated moving to another home channel, (2) its tolerable range uncertainty has not been exceeded (see 5.1.4 a), and (3) it has not lost CCOW acquisition on the original home channel as defined in 5.1.3. The terminal shall report the acquisition of a new home channel has failed and the terminal has returned to a previously assigned home channel by transmitting an RCCOW:Status Report B message for I/O Port #1. The terminal shall use the Channel Frequency Code field based on Table D-I to determine the satellite channel on which to operate.

(1) Move to another 25-kHz channel. If the Channel Frequency Code field indicates a 25-kHz channel, identified terminals shall move to the new home channel and continue operation as specified in this standard, retaining all RCCOW messages in queue. Communications in established user time slots may be temporarily interrupted while acquiring the new home channel. If the format change results in a change from Format number 1 to Format number 2 or from Format number 2 to Format number 1, the terminal shall disconnect all slot connections in all user segments and cancel any special format change order in effect. If the frame format on the new home channel is different than the frame format that the terminal is currently operating under, slot connections located in changed subformat segments will be disconnected. Depending on the state of the All-Change flag the terminal will maintain, move, or disconnect existing slot connections as specified below.

- When the All-Change flag is set to binary 1, all non-frequency switched slot connections shall be moved to the new home channel and the terminal shall continue to range in any previously established dedicated ranging time slots on the new home channel. If the Satellite Change flag is set to binary 0, all frequency-switched slot connections shall be maintained on their previously assigned channels. If the Satellite Change flag is set to binary 1, all frequency-switched slot connections shall be disconnected.

- When the All-Change flag is set to binary 0, a terminal specified in one of the User ID fields shall reestablish ranging on the new home channel. If the Satellite Change flag is set to binary 0, all slot connections shall be maintained on their previously assigned channels. If the Satellite Change flag is set to binary 1, all slot connections shall be disconnected.

(2) Move to a 5-kHz channel. If the Channel Frequency Code field indicates a 5-kHz channel, identified terminals shall switch to operations as specified in MIL-STD-188-182A. All slot connects shall be disconnected and all RCCOW messages in queue shall be deleted.

The terminal shall interpret the data fields in this CCOW as follows:

a. Channel Frequency Code (Bits 0-7, byte 4). This field identifies the code corresponding to the new set of rf uplink and downlink frequencies that the terminal is assigned to use as shown in Table D-I.

b. All-Change Flag (Bit 7, byte 7). This flag, when set to binary 1, directs all terminals on the channel to change their home channel. When set to binary 0, this CCOW is directed only to terminal(s) identified in the User #1 ID, User #2 ID, and User #3 ID fields.

c. Satellite Change Flag (Bit 6, byte 7). This flag, when set to binary 1,indicates that the home channel that the terminal is being directed to move to is being transponded by a different satellite. When set to binary 0, the new home channel is being transponded on the same satellite as the terminal’s current home channel.

d. User #1 ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies a terminal base address or guard address. This field is set to binary 0 when the All-Change flag is set to binary 1.

e. User #2 ID (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies a second terminal base address or guard address. This field is set to binary 0 when only one address is directed to a new home channel or when the All-Change flag is set to binary 1.

f. User #3 ID (Bits 0-7, byte 12 and bits 0-7, byte 13). This field identifies a third terminal base address or guard address. This field is set to binary 0 when two or fewer addresses are directed to a new home channel or the All-Change flag is set to binary 1.

5.2.1.1.2.9.2 DASA Channel Assignment (Figure B-10) (Command Field Code 10101). This CCOW message directs up to two specific terminals, guard addresses, or all terminals to temporarily change to a DASA channel. Terminal requests for DASA channel assignment may be made, but are not limited to, using the Configuration Code field in both the RCCOW:Two Party and Conference Request messages. The terminal shall determine the satellite channel on which to operate based on the Channel Frequency Code field and Table D-I. Terminals shall comply with the bandwidth of the assigned channel. Terminals shall return to their assigned home channel (the channel where they received the assignment) under either of the following conditions: (1) after communications are completed, or (2) after the time defined in the Time field expires. Terminals returning to their home channel for a reason other than time expiration shall transmit an RCCOW:Call Complete message after regaining transmit timing on their assigned home channel. The DASA channel operates in the single access mode as specified in MIL-STD-188-181A. Terminal actions prior to movement to and upon return from a DASA channel are as follows:

! Prior to switching to the DASA channel (5- or 25-kHz) the terminal shall disconnect all slot connects. The terminal may retain all pending service requests in its queue prior to switching to the DASA channel. The CC will not increment the queue service timers for retained service requests.

! The terminal shall interpret the data fields in this CCOW as follows:

a. Channel Frequency Code (Bits 0-7, byte 4). This field identifies the code corresponding to the set of rf uplink and downlink frequencies that the terminal is assigned to use as shown in Table D-I.

b. All-Change Flag (Bit 7, byte 7). This flag, when set to binary 1, directs all terminals on the channel to change to a DASA channel. This field is set to binary 0 when either or both of the User #1 and User #2 ID fields are set to other than binary 0.

c. Satellite Change Flag (Bit 6, byte 7). This flag, when set to binary 1, indicates that the DASA channel that the terminal is being directed to operate on is being transponded by a different satellite. When set to binary 0, then the new DASA channel is being transponded on the same satellite as the terminal’s home channel.

d. User #1 ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies an I/O port or guard address. Terminals identified by this address are directed to change to the DASA channel identified in the Channel Frequency Code field. This field is set to binary 0 if the All-Change flag field is set to binary 1.

e. User #2 ID (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies a second I/O port or guard address and requires the same terminal action for this address as required for the User #1 ID field. This field is set to binary 0 if only one address is being directed to a DASA channel or if the All-Change flag field is set to binary 1.

f. Time (Bits 0-7, byte 12). This field defines the time the addressed terminals will remain on the DASA channel in the format defined in 5.2.1.1.2.3 g. Nonzero data in this field indicates the terminals are to terminate baseband communications on the DASA channel and return to their assigned home channel when the identified time has elapsed. Binary 0 in this field indicates an unlimited channel assignment.

g. Configuration Code (Bits 0-7, byte 13). This field identifies the configuration code of the requesting terminal's I/O port in HEX format. Valid codes range from 01 to FF and are operationally assigned.

5.2.1.1.2.10 Enter Guard List (Figure B-11) (Command Field Code 01000). This CCOW message directs a terminal to enter up to two addresses into the guard list of the addressed I/O port. The terminal whose I/O port is identified in the user ID field shall enter into the specified I/O port guard list the guard addresses received. Guard addresses shall be entered in the order (i.e., Guard #1, Guard #2) received, up to the maximum number (15) that can be guarded. The terminal shall not allow local or CCOW entry of duplicate guard addresses into the terminal. The terminal shall interpret the data fields in this CCOW as follows:

a. User ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the I/O port address to which the addresses in the Guard #1 and Guard #2 fields are to be added.

b. Guard #1 (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies an address. This address is entered into the guard list of the I/O port identified in the User ID field.

c. Guard #2 (Bits 0-7, byte 12 and bits 0-7, byte 13). This field identifies another address. This address is entered into the guard list of the I/O port identified in the User ID field. If only one address is being added to the terminal's guard list, this field is set to binary 0.

5.2.1.1.2.11 Delete from Guard List (Figure B-12) (Command Field Code 01001). This CCOW message directs a terminal to delete up to two addresses from the guard list of the addressed I/O port. Terminal I/O ports connected to a slot assigned to a deleted guard address shall disconnect from the slot. The terminal shall interpret the data fields in this CCOW as follows:

a. User ID (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the I/O port address from which the addresses identified in the Guard #1 and Guard #2 fields are to be deleted.

b. Guard #1 (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies an address that the terminal is to delete from its guard list.

c. Guard #2 (Bits 0-7, byte 12 and bits 0-7, byte 13). This field identifies a second address that the terminal is to delete from its guard list. This field will be set to binary 0 if only one address is being deleted from the terminal's guard list.

5.2.1.1.2.12 Call Waiting (Figure B-13) (Command Field Code 01010). This CCOW message notifies a terminal that a call addressed to one of its I/O port or guard addresses is waiting to be connected. Terminal system specifications should define required terminal actions upon receipt of this message. The terminal shall interpret the data fields in this CCOW as follows:

a. Called Party (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the I/O port or guard address for which a call is waiting.

b. Calling Party (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies the I/O port address that made the call request.

c. Precedence (Bits 0-2, byte 12). This field identifies the precedence of the CCOW:Call Waiting message as shown in Table XII.

5.2.1.1.2.13 Call in Queue (Figure B-14) (Command Field Code 01011). This CCOW message notifies up to two terminal I/O ports that their call requests have been placed in queue. Terminal system specifications should define required terminal actions upon receipt of this message. The terminal shall interpret the data fields in this CCOW as follows:

a. Calling Party #1 (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the address of the first I/O port that requested a call that was placed in queue.

b. Calling Party #2 (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies the address of the second I/O port that requested a call that was placed in queue. This field is set to binary 0 if only one call has been placed in queue.

c. Time #1 (Bits 0-7, byte 12). This field provides an estimate of the time until the call requested by Calling Party #1 field will be serviced. The time is in the format defined in 5.2.1.1.2.3 f. A binary zero value in this field indicates no time estimate is provided.

d. Time #2 (Bits 0-7, byte 13). This field provides an estimate of the time until the call requested by Calling Party #2 field will be serviced. The time is in the format defined in 5.2.1.1.2.3 f. This field is set to binary 0 if no Calling Party #2 is specified, or if a second calling party is specified to indicate no time estimate is provided.

5.2.1.1.2.14 Computer Data Transfer (Figure B-15) (Command Field Code 01100). This CCOW message transfers four bytes of data to a specified terminal port address. Terminal specifications should define the terminal to I/O device interface and/or information to be made available to the operator upon receipt of this CCOW. The terminal shall interpret the data fields in this CCOW as follows:

a. Called Party (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the I/O port or guard address to which the data is to be transferred.

b. Precedence (Bits 5-7, byte 7). This field identifies the precedence of the transfer data. See Table XII.

c. Data (Bits 0-7, byte 10; bits 0-7, byte 11; bits 0-7, byte 12; and bits 0-7, byte 13). This field contains the data to be transferred. Byte 10 (see Figure B-15) is the most significant byte of the message, byte 11 is next, byte 12 is third, and byte 13 is the least significant byte.

5.2.1.1.2.15 Information Request (Figure B-16) (Command Field Code 01101). This CCOW message has two purposes, as defined in 5.2.1.1.2.15.1 and 5.2.1.1.2.15.2. The terminal system specifications should define required terminal actions upon receipt of this CCOW. The terminal shall interpret the data fields in this CCOW as follows:

a. Called Party (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the I/O port or guard address to which the CCOW is directed.

b. Code (Bits 0-7, byte 10). This field identifies the information request code in binary-coded decimal (BCD) format. Valid codes are 1 to 99 and except for Code = 4 are operationally defined. Code = 4 is reserved for the Constant Key Alarm Information Request.

5.2.1.1.2.15.1 Operational Code Information Request. This CCOW message conveys a CC operator information-request code, specified in the Code field, to the terminal I/O port or guard address identified in the Called Party field. The terminal shall identify the specific request by the value in the Code field. The codes are 1-99 with the exception of Code = 4. The terminal operator may respond to this information request by directing the terminal to send an RCCOW:Information Report message.

5.2.1.1.2.15.2 Constant Key Alarm Information Request. The CC sends this request in response to a RCCOW:Information Report message reporting a constant key alarm as described in 5.2.1.2.2.6.2. The terminal shall identify the Constant Key Alarm Information Request by the value in the Code field (Code = 4). If the addressed terminal I/O port did not report a constant key condition via the RCCOW:Information Report message, the terminal shall ignore this CCOW:Information Request message. If the addressed I/O port did report a constant key condition, the terminal shall automatically disconnect that I/O port from its assigned time slot.

5.2.1.1.2.16 Zeroize (Figure B-17) (Command Field Code 01110). This CCOW message directs a terminal to zeroize the orderwire KG key storage memories and disconnect all slot connects. If the addresses in the Called Party #1 and Called Party #2 fields both match the terminal's terminal base address, the terminal shall erase all KG memory locations and terminate all baseband communications (disconnect all I/O ports). If the three addresses do not match, the command shall not be executed. The terminal shall interpret the data fields in this CCOW as follows:

a. Called Party #1 (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the terminal base address of the requested terminal.

b. Called Party #2 (Bits 0-7, byte 10 and bits 0-7, byte 11). This field also identifies the terminal base address of the requested terminal.

5.2.1.1.2.17 Time-Slot Preparation (Figure B-18) (Command Field Code 01111). This CCOW message directs all terminals on an rf channel to change the manner in which they prepare their KGs for encryption and decryption of orderwire messages. Table XV describes all combinations of KG parameters possible.

5.2.1.1.2.17.1 CC-Directed Time-Slot Preparation. CC-directed KG parameter changes are accomplished by transmitting a binary 1 in the fields noted in Table XV. The terminal shall interpret the data fields in this CCOW as follows:

a. Frame Count (Bits 0-4, byte 10; bits 0-7, byte 11; and bits 0-7, byte 12). This field specifies the frame count at which the terminal begins using the new KG parameters indicated in the fields described in b through f below.

b. TS0 Flag (Bit 7, byte 7). If this flag is set to binary 1, all terminals perform a TS0 at the frame count given in this CCOW. The result is that new variables are used to prepare the KG, and the frame count is reset as defined in Table XV.

TABLE XV. KG parameter change flags.

FLAG VALUES			TERMINAL ACTION
TS0	**CHANGE KG DAY**	**CHANGE KG MEMORY**	
0	0	0	The KG Day and the KG Memory are not changed. The frame count is incremented.
0	0	1	The KG Day is not changed. The terminal changes to the KG Memory location specified in the KG Memory Address field. The previous KG Memory location is not erased. The frame count is incremented.
0	1	0	The terminal changes to the KG Day specified in the KG Day field. The KG Memory is not changed. The frame count is incremented.
0	1	1	The terminal changes to the KG Day and the KG Memory location specified in the KG Day and KG Memory Address fields. The previous KG Memory location is not erased. The frame count is incremented.
1	0	0	When operating in the weekly mode, the KG Day is incremented.* If the KG Day equaled 7 prior to the change, or if operating in the daily mode, the terminal changes to the paired KG Memory location** and the previous KG Memory location is erased. Otherwise, the KG Memory location is not changed. The frame count reset to 24.

1	0	1	The terminal changes to the KG Memory location specified in the KG Memory Address field. When operating in the weekly mode, the KG Day is incremented.* If the KG day equaled 7 prior to the change or if operating in the daily mode , the previous KG Memory location is erased. The frame count reset to 24.
1	1	0	The terminal changes to the KG Day specified in the KG Day field. If KG Day equaled 7 prior to the change, or if operating in the daily mode after the change, the terminal changes to the paired KG Memory location** and the previous KG Memory location is erased. Otherwise, the KG Memory location is not changed. The frame count reset to 24.
1	1	1	The terminal changes to the KG Day and KG Memory location specified in the KG Day and KG Memory Address fields. If the KG day equaled 7 prior to the change or if operating in the daily mode after the change, the previous KG Memory location is erased. The frame count reset to 24.

* When the KG Day is equal to 7, incrementing the KG Day results in a rollover to a KG Day equal to 1. When operating in daily mode (KG Day = 0), the KG Day is not changed.

** KG Memory locations 0-1, 2-3, 4-5, and 6-7 are paired KG Memory locations.

c. Change KG Day Flag (Bit 4, byte 13). If this flag is set to binary 1, all terminals change the KG day variable used to prepare the KG. The change occurs at the frame count given in this CCOW, and the new KG day is the one given in this CCOW as defined in Table XV.

d. Change Memory Flag (Bit 0, byte 13). If this flag is set to binary 1, all terminals change the KG memory in use. The change occurs at the frame count given in this CCOW, and the new KG memory is that given in this CCOW as defined in Table XV.

e. KG Day (Bits 5-7, byte 13). This field identifies the new KG day variable to be used to prepare the KG.

f. KG Memory Address (Bits 1-3, byte 13). This field identifies the binary address of the new KG memory location. The old KG memory location is erased as defined in Table XV.

5.2.1.1.2.17.2 Self-Initiated Time-Slot Preparation. When a terminal receives a CCOW:Master Frame message with a changed KG Day, changed KG Memory, or reduced Frame Count, and the terminal has not received a CCOW:Time Slot Preparation message for the new value(s), the terminal shall perform a Time Slot Preparation operation that duplicates the operation that would have been performed if the CCOW:Time-Slot Preparation message had been received. This self-initiated time slot preparation shall be performed before the terminal uses the new values to perform an encryption. If the KG Day equaled 7 prior to the change, or if operating in the daily mode after the change, the previous memory location shall be erased. Otherwise, the KG Memory location shall not be erased.

5.2.1.1.2.18 Requested Party Out-of-Service (Figure B-19) (Command Field Code 10000). This CCOW message notifies up to two I/O port addresses which have made service requests that their requested party is out of service. Terminals should respond in accordance with the direction specified in the terminal system specification upon receipt of this message. The terminal shall interpret the data fields in this CCOW as follows:

a. Calling Party #1 (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the I/O port address that made a service request.

b. Calling Party #2 (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies the second I/O port address that made a service request. If there is only one address being advised that the requested party is out of service, this field is set to binary 0.

c. Time #1 (Bits 0-7, byte 12). This field identifies the estimated amount of time that the party requested by the I/O port address in the Calling Party #1 field is to be out of service. This field is in the format defined in 5.2.1.1.2.3 f. This field is set to binary 0 if no estimate is available of how long the requested party is to be out of service.

d. Time #2 (Bits 0-7, byte 13). This field identifies the estimated amount of time that the party requested by the I/O port address in the Calling Party #2 field is to be out of service. This field is in the format defined in 5.2.1.1.2.3 f. This field is set to binary 0 if no estimate is available of how long the second requested party is to be out of service or if the Calling Party #2 field is set to binary 0.

5.2.1.1.2.19 Transmit Control (Figure B-20) (Command Field Code 10001). This CCOW message directs all terminals on an rf channel either to inhibit or enable their transmissions on the rf channel. If the Transmit flag (Bit 7, byte 7) is set to binary 0, all terminals shall inhibit their rf transmissions and shall disconnect all I/O ports connected to time slots. If this flag is set to binary 1, all terminals are enabled for rf transmission. The terminal shall not automatically re-connect its I/O port(s) to the time slot(s) when the CC re-enables rf transmissions.

5.2.1.1.2.20 Satellite Ephemeris Data (Figure B-21A, B-21B, and B-21C). (Command Field Code 10010). This CCOW message provides satellite ephemeris data for the two satellites in the coverage area and will be transmitted, at least, once daily. Terminals may use this information to support passive ranging. Three CCOW message transmissions are required to provide a complete set of satellite ephemeris data. These three CCOW messages share a single Command Field code but have different data fields. The Ephemeris Group (EG) field, a common field in all three messages, identifies which of the three ephemeris messages has been sent in this CCOW. The ephemeris epoch time is 0000Z (midnight) on the day, month, and year provided in the data fields. All three CCOW messages must be received in the same master frame epoch to be valid. Data fields in the messages are as follows:

a. Ephemeris Group (EG) (Bits 6-7, byte 7). This field contains a two bit binary code that identifies which of the three satellite ephemeris data groups is contained in this message.

b. Satellite ID (Bit 6, byte 4, EG = 00). This field indicates to which of the two satellites in the coverage area these ephemeris data apply. A binary 1 indicates these ephemeris data apply to this satellite (that is, the satellite on which this CCOW message was transmitted). A binary zero in this field indicates the data apply to the other satellite in the coverage area.

c. Epoch Year Flag (Bit 5, byte 4, EG = 00). This field contains a flag for the year of the epoch time. A binary 0 represents even numbered years. A binary 1 represents odd numbered years.

d. Epoch Month (Bits 0-4, byte 4, EG = 00). This field identifies the month of the epoch time. Values 1 through 12 represent January through December respectively.

e. Mean Anomaly (Bits 0-7, byte 8; bits 0-7, byte 9; and bits 0-7, byte 10; EG = 00). This data identifies the angular position the satellite would occupy if it travelled at a constant angular velocity equal to its Mean Motion. The position is represented as a fraction of a revolution measured in the direction of satellite motion from Argument of Perigee. The value of the LSB of this field is 2^{-24}.

f. Mean Motion (Bits 0-7, byte 11; bits 0-7, byte 12; and bits 0-7, byte 13; EG = 00). This field identifies the average rate of change in position (velocity) over the entire orbit measured in radians per earth canonical time unit (one earth canonical time unit = 13.44686457 minutes). A decimal point is assumed at the left of the MSB.

g. Epoch Day (Bits 0-4, byte 4, EG = 01). This field identifies the day of the epoch time. Values 1 through 31 represent the day of the month.

h. Eccentricity (Bits 0-7, byte 8; bits 0-7, byte 9; and bits 0-7, byte 10; EG = 01). This field contains the eccentricity of the satellite orbit. The value of the LSB of this field is 2^{-24}.

i. Argument of Perigee (Bits 0-7, byte 11; bits 0-7, byte 12; and bits 0-7, byte 13; EG = 01). This field identifies the position of the satellite orbit perigee. The position is represented as a fraction of a revolution measured in the direction of satellite motion from the Ascending Node. The value of the LSB of this field is 2^{-24}.

j. Longitude of Ascending Node (Bits 0-7, byte 8; bits 0-7, byte 9; and bits 0-7, byte 10; EG = 10). This field contains the east longitude of the Ascending Node at epoch time expressed as a fraction of a revolution. The value of the LSB of this field is 2^{-24}.

k. Inclination (Bits 0-7, byte 11, bits 0-7, byte 12 and bits 0-7, byte 13, EG = 10). This field identifies the angle between the Earth’s equatorial plane and the satellite’s orbital plane measured counterclockwise at the ascending node. This angle is expressed as a fraction of a revolution. The value of the LSB of this field is 2^{-24}.

5.2.1.2 RCCOW in the AC mode. The terminal shall be capable of transmitting the RCCOW message types listed in Table XVI, except for those types identified as optional or spare. If a terminal is required per its specification to be able to perform as a primary or alternate channel controller, it shall be capable of receiving and transmitting the RCCOW:Acknowledge Channel Control Request message. If a terminal is required per its specification to transmit RCCOW:Data Transfer messages, the terminal shall be capable of receiving RCCOW:Data Transfer messages. Several of these RCCOW message types are transmitted in response to an RCCOW assignment code sent by the CC in the RCCOW Assignment field of a CCOW message. These are listed in

Table XVII. There are five common fields in the RCCOW message formats: (1) Scrambled Terminal KG ID, (2) Message Code, (3) Initial Entry Flag, (4) Stored Call Flag, and (5) Parity fields. Fields unique to each RCCOW message are defined in 5.2.1.2.2.1 through 5.2.1.2.2.13.

TABLE XVI. AC mode RCCOW message codes.

MESSAGE NAME	CODE
Status Report B	00001
Data Transfer (Type B)*	00010
Link Test Request	00011
Call Complete	00100
Out-of-Service	00101
Information Report	00110
Two-Party Request (or Cancel Call)	00111
Spare	01000
Conference Party List	01001
C/N_o and Link Test Results	01010
Status Report A	01011
Acknowledge Channel Control Request *	01100
Spare	01101
Paging	01110
Data Transfer (Type A) *	01111
Conference Request (or Cancel Call)	10000
Guard List Report	10001
Spare	10010-11111

* optional messages

TABLE XVII. AC mode RCCOW Assignment message codes.

RCCOW	CCOW COMMANDS (RCCOW ASSIGNMENT FIELD CODE)
Conference Party List	00110
Status Report A: Group 1	01001
Status Report A: Group 2	10001
Status Report B: Group 1	01010
Status Report B: Group 2	10010
Report Link Test Results	01011
Guard List Report: Group 1	01100
Guard List Report: Group 2	01101
Guard List Report: Group 3	01110
Guard List Report: Group 4	01111
Guard List Report: Group 5	10011

5.2.1.2.1 Common AC mode RCCOW fields. The terminal shall set the five common fields in every RCCOW as described below.

a. Scrambled Terminal KG ID field (Bits 0-7, byte 1 and bits 0-7, byte 2). This field identifies the Scrambled Terminal KG ID number of the terminal that initiated the RCCOW.

b. Message Code field (Bits 0-4, byte 3). This field identifies which RCCOW message is transmitted in this frame. The messages and associated codes are listed in Table XVI.

c. Initial Entry Flag (AC mode only) (Bit 7, byte 4). This flag, when set to binary 1, identifies this as the first RCCOW created by a terminal after its power has been turned on.

d. Stored Call Flag (AC mode only) (Bit 6, byte 4). This flag, when set to binary 1, indicates that the terminal has one or more additional unsolicited RCCOW messages queued for transmission. The terminal is not required to report queued RCCOW:Conference Party List messages.

e. Parity field (Bits 0-7, byte 12 and bits 0-7, byte 13). This field contains the 2-byte CRC, specified in 5.4.3, for RCCOW messages.

5.2.1.2.2 RCCOW message unique fields. All fields unique to each RCCOW message are defined in 5.2.1.2.2.1 through 5.2.1.2.2.13.

5.2.1.2.2.1 Status Report B (Figure C-1) (Message Code 00001). The terminal shall be capable of generating this RCCOW in four ways: (1) by local initiative (such as, but not limited to, operator entry), (2) automatically in response to receipt of a Status Report B RCCOW Assignment code in a CCOW message, (3) automatically whenever a change is made to an I/O port configuration code, and (4) automatically when returning from a failed TDMA channel reassignment. The Port Configuration Code, Port Configuration Change Flag, and Port Bit Rate fields of RCCOW:Status Report B messages shall apply to the I/O port whose address is included in the Reporting Party field. The Port #n Number in Guard List and Port #n Guard List Change Flag shall apply to the first through fourth I/O ports when the I/O port indicated in the Reporting Party field is in Group 1 or the fifth through eighth I/O ports when the I/O port indicated in the Reporting Party field is in Group 2. If a terminal with four or fewer I/O ports receives a Status Report B: Group 2 RCCOW Assignment code, it shall respond with a RCCOW:Status Report A: Group 1 message. The terminal shall set each of the fields in this RCCOW as follows:

a. Reporting Party (Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5). This field identifies the address of the terminal I/O port that initiated the RCCOW.

b. Port Configuration Code (Bits 0-7, byte 6). This field identifies the configuration code of the terminal I/O port that initiated the RCCOW. The configuration code defines the I/O port bit rate and the type of baseband equipment connected to the I/O port in HEX format. Valid codes range from 1 to FF and are operationally assigned.

c. Port Configuration Change Flag (Bit 3, byte 7). This flag when set to binary 1 indicates that the terminal I/O port has changed the configuration code.

d. Port Bit Rate (Bits 0-2, byte 7). This field contains a 3-bit code, identifying the bit rate of the I/O port that initiated the RCCOW, as defined in Table XIV.

e. Port #1 (#5) Number in Guard List (Bits 4-7, byte 8). This field contains a binary number indicating how many of the terminal guarded addresses (15 maximum) are in the I/O port #1 (#5) guard list.

f. Port #2 (#6) Number in Guard List (Bits 0-3, byte 8). This field contains a binary number indicating how many of the terminal guarded addresses (15 maximum) are in the I/O port #2 (#6) guard list.

g. Port #3 (#7) Number in Guard List (Bits 4-7, byte 9). This field contains a binary number indicating how many of the terminal guarded addresses (15 maximum) are in the I/O port #3 (#7) guard list.

h. Port #4 (#8) Number in Guard List (Bits 0-3, byte 9). This field contains a binary number indicating how many of the terminal guarded addresses (15 maximum) are in the I/O port #4 (#8) guard list.

i. Port #1 (#5) Guard List Change Flag (Bit 7, byte 10). This flag, when set to binary 1, indicates that the terminal has changed the I/O port #1 (#5) guard list since the last time the terminal created a RCCOW:Status Report B message.

j. Port #2 (#6) Guard List Change Flag (Bit 6, byte 10). This flag, when set to binary 1, indicates that the terminal has changed the I/O port #2 (#6) guard list since the last time the terminal created a RCCOW:Status Report B message.

k. Port #3 (#7) Guard List Change Flag (Bit 5, byte 10). This flag, when set to binary 1, indicates that the terminal has changed the I/O port #3 (#7) guard list since the last time the terminal created a RCCOW:Status Report B message.

l. Port #4 (#8) Guard List Change Flag (Bit 4, byte 10). This flag, when set to binary 1, indicates that the terminal has changed the I/O port #4 (#8) guard list since the last time the terminal created a RCCOW:Status Report B message.

m. Frame Format (Bits 0-3, byte 10 and bits 0-7, byte 11). This field identifies the frame subformat in use by the terminal for each user segment (see 5.1.1.1 and 5.2.1.1.2.1 b.)

5.2.1.2.2.2 Data Transfer. This RCCOW message is used to transfer data between two terminals. The data shall be received and processed by any terminal with a requirement for this data transfer capability. If the terminal is required to have this capability, it shall be capable of receiving and transmitting two types of data transfer messages: RCCOW:Data Transfer (Type A) and Data Transfer (Type B) messages. Terminal specifications should define the terminal to I/O device interface and/or information to be made available to the terminal operator upon receipt of either of these RCCOWs.

5.2.1.2.2.2.1 Data Transfer (Type A) (optional) (Figure C-2) (Message Code 01111). This RCCOW is used to exchange data between 16-bit address terminals. The terminal shall set each of the fields in this RCCOW as follows:

a. Precedence (Bit 5, byte 3). This field identifies the precedence of the RCCOW to be transmitted. When the Data Transfer (Type A) RCCOW is transmitted in a dedicated RCCOW time slot, its precedence bit is set to binary 0. When the RCCOW is transmitted in a slot that is open to any terminal, this bit is set to binary 1 to indicate that the message is a higher precedence than the precedence level specified in the RCCOW Assignment field; or to binary 0 to indicate the precedence is equal to the precedence level specified in the RCCOW Assignment field.

b. Requesting Party (Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5). This field identifies the address of the requesting terminal I/O port.

c. Requested Party (Bits 0-7, byte 6 and bits 0-7, byte 7). This field identifies the address of the terminal I/O port to which the RCCOW is directed.

d. Data Block (Bits 0-7, byte 8; bits 0-7, byte 9; bits 0-7, byte 10; and bits 0-7, byte 11). This field is composed of four bytes of data. It is the information that the requesting party transfers to the requested party. Byte 8 of the RCCOW (see Figure C-2) is the most significant byte of the message, byte 9 is next, byte 10 is third, and byte 11 is the least significant byte.

5.2.1.2.2.2.2 Data Transfer (Type B) (optional) (Figure C-3) (Message Code 00010). This RCCOW is used to exchange data between 14-bit address terminals, or between 16-bit and 14-bit address terminals. The terminal shall set each of the fields in this RCCOW as follows:

a. Precedence (Bits 5-7, byte 3). This field identifies the precedence of the RCCOW to be transmitted. See Table XII.

b. Requesting Party (Bits 0-5, byte 4 and bits 0-7, byte 5). This field identifies the address of the requesting terminal I/O port. In the case of data transfer from a 16-bit address terminal to a 14-bit address terminal, the two MSBs of the requesting party's 16-bit address are not transmitted.

c. Requested Party (Bits 0-5, byte 6 and bits 0-7, byte 7). This field identifies the address of the requested terminal I/O port.

d. Data Block (Bits 0-7, byte 8; bits 0-7, byte 9; bits 0-7, byte 10; and bits 0-7, byte 11). This field is composed of four bytes of data. It is the information that the requesting party transfers to the requested party. Byte 8 of the RCCOW (see Figure C-3) is the most significant byte of the message, byte 9 is the next, byte 10 is third, and byte 11 is the least significant byte.

5.2.1.2.2.3 Link Test Request (Figure C-4) (Message Code 00011). This RCCOW requests a link test assignment. It shall be locally initiated (such as, but not limited to, operator entry). Only one of the Bit Rate flags described in b, c, and d, below, shall be set to binary 1 for each RCCOW:Link Test Request message. The terminal shall set each of the fields in this RCCOW as follows:

a. Requesting Party (Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5). This field identifies the terminal base address (I/O port #1) of the terminal that initiated the RCCOW.

b. 9.6-ksps Flag (Bit 0, byte 6). This flag, when set to binary 1, indicates that the terminal requests a 9.6-ksps link test.

c. 19.2-ksps Flag (Bit 1, byte 6). This flag, when set to binary 1, indicates that the terminal requests a 19.2-ksps link test.

d. 16-ksps Flag (Bit 2, byte 6). This flag, when set to binary 1, indicates that the terminal requests a 16-ksps link test.

5.2.1.2.2.4 Call Complete (Figure C-5) (Message Code 00100). A terminal sends this RCCOW message to indicate (1) the terminal I/O port specified in the Requesting Party field has disconnected from a service assigned to a DAMA time slot, (2) the terminal I/O port specified in the Requesting Party field has disconnected from a service assigned to a DAMA time slot and that service is to be terminated, or (3) the terminal associated with the I/O port address specified in the Requesting Party field is returning from a DASA channel. This RCCOW shall be locally initiated (such as, but not limited to, operator entry). The terminal I/O port initiating the RCCOW:Call Complete message shall disconnect itself from the time slot when the RCCOW:Call Complete is acknowledged by the CC or a CCOW:Slot Disconnect message is received while the RCCOW:Call Complete message is being processed. The terminal shall set each of the fields in this RCCOW as follows:

a. Requesting Party (Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5). This field identifies the address of the terminal I/O port reporting call completion.

b. Slot Disconnect Flag (Bit 5, byte 3). This flag is set to binary 1 to report that the service is terminated and all terminal I/O ports assigned to this service are disconnecting. The flag is set to a binary 0 to report that only the terminal identified by the address in the Requesting Party field is disconnecting from the service.

c. Time-Slot Number (Bits 0-4, byte 6). This field identifies the time slot from which the terminal(s) are disconnected. Slot numbers for time slots on 25-kHz control and slave channels will range from 1 to 23, depending on the frame format in use (see Figures A-1 through A-3). Slot numbers for time slots on 5-kHz slave channels will range from 1 to 28 (see Figure A-4). The value of this field is set to binary 0 if the call completion applies to a DASA channel.

d. Channel Frequency Code (Bits 0-7, byte 7). This field identifies the channel frequency code where the service was completed. The codes corresponding to the uplink and downlink frequencies will be as shown in Table D-I.

5.2.1.2.2.5 Out-of-Service (Figure C-6) (Message Code 00101). This RCCOW reports that the user connected to the reporting I/O port will not be available for communications services for an estimated period of time. It shall be locally initiated (such as, but not limited to, operator entry). The terminal shall not automatically disconnect the reporting I/O port from an existing service when transmitting this RCCOW. The terminal shall set each of the fields in this RCCOW as follows:

a. Precedence (Bits 5-7, byte 3). This field identifies the precedence of the RCCOW to be transmitted. See Table XII.

b. Requesting Party (Bits 0-5, byte 4; bits 0-7, byte 5; and bits 6-7, byte 7). This field identifies the address of the I/O port reporting the out-of-service condition.

c. Time Out-of-Service (Bits 0-7, byte 6). This field identifies the estimated time the I/O port will be out of service. This field is composed of a 6-bit time subfield (bits 0-5) and a two-bit time unit code subfield (bits 6-7) defined in 5.2.1.1.2.3 f. Binary 0 in this field indicates an indefinite period out-of-service.

d. Out-of-Service Code (Bits 0-7, byte 8). This field identifies the reason code for going out-of-service in BCD format. Valid codes range from 1 to 99 and are operationally assigned.

5.2.1.2.2.6 Information Report (Figure C-7) (Message Code 00110). A terminal shall be capable of generating this RCCOW automatically as a result of a constant key condition and by local initiative (such as, but not limited to, operator entry), either in response to a CCOW:Information Request message or as an unsolicited report. The RCCOW:Information Report message shall be generated as specified in 5.2.1.2.2.6.1 and 5.2.1.2.2.6.2. The terminal shall set each of the fields in this RCCOW as follows:

a. Responding Party (Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5). This field identifies the address of the reporting terminal I/O port.

b. Response Code (Bits 0-5, byte 6 and bits 0-7, byte 7). This field contains a code which may represent a response to a CCOW:Information Request message. Valid codes range from 1 to 16,383 (AC) or 1 to 255 (DC) and are operationally assigned. Response code 200 is reserved for the Constant Key Alarm Information Report.

c. Affected DC Circuit Number (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the DC circuit number associated with the 25-kHz DAMA time slot on which the constant key condition is occurring. See Tables A-VI through A-X for the DC circuit numbers associated with each time slot for each subformat. This field shall be set to zero when the constant key condition is occurring on a 5-kHz DAMA time slot.

5.2.1.2.2.6.1 Operational Code Information Report. The terminal (operator) may respond to the Information Request CCOW by sending an operationally-assigned code in the Response Code field of the RCCOW:Information Report message.

5.2.1.2.2.6.2 Constant Key Alarm Information Report. The Constant Key Alarm Information Report is used in conjunction with the CCOW:Information Request (Constant Key Alarm Information Request) message (see 5.2.1.1.2.15.2) to quickly regain use of a time slot by removing an illegal constantly keyed I/O port from a time slot. When a terminal I/O port has been constantly keyed for 17 minutes and has not been configured for legal constant-key operation, the terminal shall automatically generate and send this information report to the CC. The terminal shall repeat this message every 17 minutes if the constant keying persists. A terminal reporting a constant key condition shall set the Response Code field to a value of 200. If reporting a constant key condition on a 25-kHz DAMA time slot, the terminal shall set the Affected DC Circuit Number field to the DC circuit number associated with this time slot as specified in Tables A-VI through A-X. At the discretion of the CC operator, the terminal I/O port can be directed to automatically disconnect from the time slot using the CCOW:Constant Key Alarm Information Request message. A terminal may be designed to allow it to be configured to transmit in a continuous mode without reporting a constant key condition. When the I/O port's constant transmit capability is enabled, the terminal shall not output receive data for this I/O port regardless of whether the I/O port is keyed or not keyed.

5.2.1.2.2.7 Two-Party Request (or Cancel Call) (Figure C-8) (Message Code 00111). This RCCOW can be used to (1) establish a timed two-party call to one other I/O port, (2) establish a timed call to a guard address, (3) add an I/O port to an already established user-to-user call, (4) join an already established network, or (5) cancel a queued two-party call request. It shall be locally initiated (such as, but not limited to, operator entry). The terminal shall increment an I/O port’s RCCOW contention report counter (up to a maximum count of 3) each time the I/O port transmits this RCCOW message without receiving a CALL ACK. The count for an I/O port shall be set to binary 0 each time a CALL ACK is received for this RCCOW message (see 5.2.1.2.2.10). To cancel a call, terminals shall resend a copy of their original request with the Cancel Call Flag set to binary 1. The terminal shall set each field in this RCCOW as follows:

a. Precedence (Bits 5-7, byte 3). This field identifies the precedence of the RCCOW. See Table XII.

b. Requesting Party (Bits 0-5, byte 4; bits 0-7, byte 5; and bits 6-7, byte 9). This field identifies the terminal I/O port initiating the service request.

c. Cancel Call Flag (Bit 6, byte 6). This flag, when set to binary 1, indicates that the requesting party wants its pending RCCOW:Two-Party Request message canceled.

d. Requested Party (Bits 0-5, byte 6; bits 0-7, byte 7; and bits 4-5, byte 9). This field identifies the address of the requested terminal I/O port or guard address.

e. Configuration Code (Bits 0-7, byte 8). This field identifies the configuration code of the requesting terminal I/O port, in HEX format. Valid codes range from 01 to FF and are operationally assigned.

f. Contention Report (Bits 0-1, byte 11). This field contains a binary count of how many times the requesting terminal I/O port has transmitted an RCCOW:Two-Party Request or an RCCOW:Conference Request message without receiving a CALL ACK.

g. Time (Bits 0-7, byte 10). This field identifies the estimated time the communications circuit is needed. The field is composed of a 6-bit time subfield (bits 0-5) and a two-bit time unit code subfield (bits 6-7) defined in 5.2.1.1.2.3 f. This field is set to binary 0 to indicate a request for an indefinite length connection time for the two-party call.

5.2.1.2.2.8 Conference calls. These RCCOWs are used to request the establishment of a conference call with multiple terminals. It can also be used to add I/O port(s) to an existing two-party call. Conference calls can be established in two ways.

! Call to guard address. A conference call can be established by placing a call to a guard address using the RCCOW:Two Party Request message. For this method the guard address is placed in the Requested Party field. Network addresses are preestablished and the addresses assigned to them are associated with a terminal's I/O port. All terminals required to participate in a specific network should include the network address in their guard list.

! Conference request. Conference calls of up to six different addresses (requesting party and up to five addresses) can be established by using conference call messages. This allows multiple users that may not have a common guard address to participate in a conference call.

5.2.1.2.2.8.1 Conference Request (or Cancel Call) (Figure C-9) (Message Code 10000). This RCCOW can be used to (1) establish a timed conference call to one or more I/O ports, (2) establish a timed call to a guard address, (3) add one or more I/O ports to an established user-to-user call, (4) join an already established network, or (5) cancel a queued conference call request. If the number of addresses required to establish the conference is more than one, two RCCOWs shall be created. The second of these shall be the RCCOW:Conference Party List message. Conference calls are used to request time slot connects with multiple users, and shall be locally initiated (such as, but not limited to, operator entry). The terminal shall increment an I/O port’s RCCOW contention report counter (up to a maximum count of 3) each time the I/O port transmits this RCCOW message without receiving a CALL ACK. The count for an I/O port shall be set to binary 0 each time a CALL ACK is received for this RCCOW message (see 5.2.1.2.2.10). To cancel a call, terminals shall resend a copy of their original request with the Cancel Call Flag set to binary 1. The terminal shall set each of the fields in this RCCOW as follows:

a. Precedence (Bits 5-7, byte 3). This field identifies the precedence of the RCCOW. See Table XII.

b. Requesting Party (Bits 0-5, byte 4; bits 0-7, byte 5; and bits 4-5, byte 8). This field identifies the address of the requesting terminal I/O port.

c. Cancel Call Flag (Bit 6, byte 6). This flag, when set to binary 1, indicates that the requesting party wants its pending RCCOW:Conference Request message canceled.

d. List Flag (Bit 7, byte 6). This flag, when set to binary 1, indicates that the conference request is for more than one requested party; therefore, the CC will request the RCCOW:Conference Party List with an RCCOW assignment.

e. Requested Party #1 (Bits 0-5, byte 6; bits 0-7, byte 7; and bits 0-1, byte 8). This field identifies the first I/O port or guard address that has been requested for communication.

f. Contention Report (Bits 6-7, byte 8). This field contains a count of how many times the requesting terminal I/O port has transmitted RCCOW:Two-Party Request or an RCCOW:Conference Request message without receiving a CALL ACK.

g. Time (Bits 0-7, byte 10). This field identifies the estimated time the communications circuit is needed. The field is composed of a 6-bit time subfield (bits 0-5) and a two-bit time unit code subfield (bits 6-7) defined in 5.2.1.1.2.3 f. This field is set to binary 0 to indicate a request for an indefinite length connection time for the conference call.

h. Configuration Code (Bits 0-7, byte 11). This field identifies the configuration code of the I/O port that requested the conference call, in HEX format. Valid codes range from 01 to FF and are operationally assigned.

5.2.1.2.2.8.2 Conference Party List (Figure C-10) (Message Code 01001). This RCCOW is used by a terminal to identify the second through fifth addresses to be included in the conference call and is associated with the RCCOW:Conference Request (or Cancel Call) message. The terminal shall only transmit this RCCOW in response to a Conference Party List RCCOW assignment. When a conference call is requested and the number of requested addresses is greater than one, the CC will use the CCOW's RCCOW Assignment field to direct the terminal to generate a RCCOW:Conference Party List message. The terminal shall respond to the controller's direction by creating an RCCOW whose fields are as follows:

! **Requested Party #2 through #5** (Requested Party #2: Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5; Requested Party #3: bits 0-7, byte 6 and bits 0-7, byte 7; Requested Party #4: bits 0-7, byte 8 and bits 0-7, byte 9; Requested Party #5: bits 0-7, byte 10 and bits 0-7, byte 11). These fields identify up to four additional terminal I/O port or guard addresses to be included in the conference call. All bits in unused fields are set to binary 0.

5.2.1.2.2.9 C/N_o and Link Test Results (Figure C-11) (Message Code 01010). The terminal shall send this RCCOW in response to a Report Link Test Results assignment in a CCOW's RCCOW Assignment field to report C/N_o for CCOW results, C/N_o for link test bursts results, symbol errors, and missed acquisitions. Link tests are used by the CC to determine the quality of the link between two terminals to aid in efficient assignment of resources. Terminals may also request a link test. The terminal shall set only one of the flags described in g, h, and i, below, to binary 1 to indicate the bit rate at which the test was performed. The C/N_o values when measured over a complete link test shall be reported: (1) to within ± 1 dB if the actual C/N_o is between 43 and 60 dB-Hz; (2) as a value greater than 58 dB-Hz if the actual C/N_o is greater than 60 dB-Hz; or (3) as a value less than 45 dB-Hz if the actual C/N_o is less than 43 dB-Hz. The terminal shall set each of these fields as follows:

a. Reporting Party. (Bits 0-5, byte 4; bits 0-7, byte 5; bit 7, byte 6; and bit 1, byte 10). This field identifies the terminal base address of the reporting terminal.

b. C/N_o for CCOW. (Bits 0-6, byte 6). This field contains the binary value for the C/N_o measurement made on the CCOW bursts. Binary 0 equals 26.0 dB-Hz. The LSB equals 0.5 dB-Hz.

c. C/N_o for Link Test Bursts. (Bits 0-6, byte 7). This field contains the binary value for the C/N_o measurement made on the link test bursts received during the link test. Binary 0 equals 26.0 dB-Hz. The LSB equals 0.5 dB-Hz.

d. Symbol Errors. (Bits 0-6, byte 8 and bits 0-7, byte 9). If the terminal specification requires the detection of symbol errors, this field identifies the count of symbol errors detected during the link test. If the terminal specification does not require this capability, this field is set to binary 1s.

e. Missed Acquisitions. (Bits 2-7, byte 10). This field identifies the count of missed acquisitions during the link test.

f. Frames Tested. (Bits 0-7, byte 11). This field identifies the length of the link test in frames tested.

g. 9.6-ksps Flag. (Bit 5, byte 3). This flag, when set to binary 1, indicates that the link test was performed at 9.6 ksps.

h. 19.2-ksps Flag. (Bit 6, byte 3). This flag, when set to binary 1, indicates that the link test was performed at 19.2 ksps.

i. 16-ksps Flag. (Bit 7, byte 3). This flag, when set to binary 1, indicates that the link test was performed at 16 ksps.

j. Contention Flag. (Bit 0, byte 10). This flag, when set to binary 1, indicates that time slot contention was detected during the link test.

5.2.1.2.2.10 Status Report A (Figure C-12) (Message Code 01011). This message contains status information that is not contained in the RCCOW:Status Report B message and shall be transmitted only in response to an RCCOW Assignment code for this RCCOW (See Table XI) or as described in 5.2.1.2.3.2.1. Depending on whether the terminal is responding to a Status Report A: Group 1 or Status Report A: Group 2 RCCOW Assignment code, the data in the Port Bit Rate and Port Slot Assignment Number fields of this RCCOW are applicable to either the first through fourth I/O ports or fifth through eighth I/O ports of the terminal. A terminal with four or fewer I/O ports shall respond to a Status Report A: Group 2 assignment with a RCCOW:Status Report A: Group 1 message. The terminal shall maintain independent RCCOW contention report counters for each I/O port. These counters shall be initialized to binary 0 each time the terminal acquires frame lock and are incremented (up to a maximum count of 3) each time an I/O port transmits an RCCOW:Two-Party Request or RCCOW:Conference Request message without receiving a CALL ACK. When the terminal receives a CALL ACK for this RCCOW it shall clear all RCCOW contention report counters (see 5.2.1.2.2.7 and 5.2.1.2.2.8). The terminal shall set each of the fields in this RCCOW as follows:

a. Reporting Party (Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5). This field identifies the terminal base address of the terminal assigned to send the RCCOW.

b. Port #1 to #4 (or Port #5 to #8) Bit Rate (Bits 5-7, byte 6; bits 5-7, byte 7; bits 5-7, byte 8; and bits 5-7, byte 9). These fields contain a code that identifies the bit rate configuration for each I/O port. The bit rate code assignment is as specified in Table XIV. If there is no I/O port corresponding to the Port # field, the bits in the field shall be set to binary 0.

c. Port #1 to #4 (or Port #5 to #8) Slot Assignment Number (Bits 0-4, byte 6; bits 0-4, byte 7; bits 0-4, byte 8; and bits 0-4, byte 9). These fields identify the slot number to which each I/O port is assigned, if there is an active assignment. Bits within fields for I/O ports not assigned a time slot are set to binary 0.

d. Number of Users in Guard List (Bits 0-4, byte 10). This field identifies the total count of addresses in all I/O port guard lists.

e. Terminal Version (Bits 5-7, byte 10). This field identifies the highest version of MIL-STD-188-183 with which the terminal complies, as defined in Table XVIII.

TABLE XVIII. Terminal standard version codes.

TERMINAL STANDARD VERSION	CODE
MIL-STD-188-183	0
MIL-STD-188-183A	1
Reserved	2-7

f. Contention Report (Bits 4-7, byte 11). This field contains a count of the sum of all times that all I/O ports have transmitted RCCOW:Two Party Request or Conference Request messages without receiving CALL ACKs. All individual I/O port contention counters within the terminal are cleared when a CALL ACK is received for this RCCOW. If the count to be reported is greater than 15, the terminal shall report a value of 15 in this field.

g. Special Frame Format Flag (Bit 2, byte 11). The terminal sets this flag to binary 1 when operating under a special format change order.

h. Frequency Change Flag (Bit 1, byte 11). This flag, when set to binary 1, indicates that this terminal is capable of automatic-frequency switching.

i. Full-Duplex Flag (Bit 0, byte 11). This flag, when set to binary 1, indicates that this terminal is operating with a full-duplex receiver/transmitter.

j. 5-kHz Capable Flag (Bit 3, byte 11). This flag, when set to binary 1, indicates the terminal can be reassigned to a 5-kHz DAMA channel (MIL-STD-188-182). When the flag is set to binary 0, the terminal cannot be reassigned to a 5-kHz DAMA channel.

5.2.1.2.2.11 Acknowledge Channel Control Request (Figure C-13) (Message Code 01100). This RCCOW is sent by an alternate CC to a primary CC to coordinate the transfer of control responsibility. The data fields in this RCCOW message will be defined in the CC system specification.

5.2.1.2.2.12 Guard List Report (Figure C-14) (Message Code 10001). A terminal’s guard list shall contain a maximum of 15 guard addresses. Each guard address is associated with an I/O port. This RCCOW reports a group of up to three addresses from the terminal's guard list. The terminal shall only generate this message in response to a Guard List Report RCCOW assignment from the CC. A terminal shall report its guard addresses by filling the three Guarded #n fields in this message in sequence, leaving no gaps. The CC directs a terminal to report any one of five Guard List Report groups. Each report group contains three guard addresses, allowing a terminal to report up to fifteen guard addresses. The terminal shall report the group of guard addresses as specified in Table XIX. The terminal shall set each field of this RCCOW as follows:

TABLE XIX. Guard List Report RCCOW Assignment responses.

RCCOW ASSIGNMENT FIELD CODE	GUARD LIST REPORT GROUP NUMBER	GUARDED ADDRESS IN LIST
01100	1	1
		2
		3
01101	2	4
		5
		6
01110	3	7
		8
		9
01111	4	10
		11
		12
10011	5	13
		14
		15

a. Port Guarding #1 (Bits 0-2, byte 4). This field identifies the terminal I/O port number which guards the address contained in the Guarded #1 field. Valid range for this field is 0 through 7. If no entries exist in the terminal's guard list for the reported group, this field is set to binary 0.

b. Port Guarding #2 (Bits 0-2, byte 5). This field identifies the terminal I/O port number which guards the address contained in the Guarded #2 field of this message. Valid range for this field is 0 through 7. If one or fewer entries exist in the terminal's guard list for the reported group, this field is set to binary 0.

c. Port Guarding #3 (Bits 4-6, byte 5). This field identifies the terminal I/O port number which guards the address contained in the Guarded #3 field of this message. Valid range for this field is 0 through 7. If two or fewer entries exist in the terminal's guard list for the reported group, this field is set to binary 0.

d. Guarded #1 (Bits 0-7, byte 6 and bits 0-7, byte 7). This field identifies the first guard address from the Guard List Report group requested by the CC. If no entries exist in the terminal's guard list for the reported group, this field is set to binary 0.

e. Guarded #2 (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the second guard address from the Guard List Report group requested by the CC. If one or fewer entries exist in the terminal's guard list for the reported group, this field is set to binary 0.

f. Guarded #3 (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies the third guard address from the Guard List Report group requested by the CC. If two or fewer entries exist in the terminal's guard list for the reported group, this field is set to binary 0.

5.2.1.2.2.13 Paging (Figure C-15) (Message Code 01110). This RCCOW shall be locally initiated (such as, but not limited to, operator entry). The RCCOW:Paging message may be used by a terminal to request the CC to page up to three I/O port or guard addresses. Typically, the terminal sends an RCCOW:Paging message after first attempting a slot connect via the RCCOW:Two-Party Call Request or the RCCOW:Conference Request message. If the CC responds to the requesting terminal that the requested addresses are busy, the terminal has the option of requesting the CC to page the requested addresses. The CC may use the CCOW:Call Waiting or CCOW:Information Request message. The terminal shall set each of the fields in this RCCOW as follows:

a. Requesting User (Bits 6-7, byte 3; bits 0-5, byte 4; and bits 0-7, byte 5). This field identifies the I/O port address of the requesting party.

b. Requested User #1 (Bits 0-7, byte 6 and bits 0-7, byte 7). This field identifies the first address to be paged.

c. Requested User #2 (Bits 0-7, byte 8 and bits 0-7, byte 9). This field identifies the second address to be paged. This field is set to binary 0 if there is not a second address to be paged.

d. Requested User #3 (Bits 0-7, byte 10 and bits 0-7, byte 11). This field identifies the third address to be paged. This field is set to binary 0 if there is not a third address to be paged.

5.2.1.2.3 RCCOW transmit decision in the AC mode. If a terminal has one or more RCCOWs in queue, or if the CC has dedicated the next RCCOW time slot for the terminal's exclusive use, the determination of whether to transmit an RCCOW and the selection of the RCCOW to transmit depends on the factors described in the following paragraphs.

5.2.1.2.3.1 Transmit disable. The terminal shall not transmit an RCCOW message if (1) a transmit inhibit condition exists, (2) range lock has been lost (see 5.1.4 a), or (3) the previous CCOW message for this channel was not received error free (see 4.8). A transmit inhibit condition may be caused by reception of a CCOW:Transmit Control message, an Inhibit RCCOW assignment, or may be imposed by the terminal operator.

5.2.1.2.3.2 RCCOW priority. RCCOW message generation may be unsolicited or solicited by the CC via an RCCOW assignment. The determination of whether to transmit an RCCOW message in the next frame and the selection of an RCCOW message to transmit depends on (1) the setting of the RCCOW Assignment field within the current CCOW message, (2) the precedence of RCCOW messages in queue, and (3) the retransmit eligibility of any queued RCCOW messages. For a discussion of retransmit eligibility, see 5.2.1.2.3.4.

5.2.1.2.3.2.1 Assigned RCCOW messages. Assigned RCCOW messages are those messages generated in response to an RCCOW assignment code sent by the CC in the RCCOW Assignment field of a CCOW message. Assigned RCCOW messages are illustrated in Figures C-1 (RCCOW:Status Report B message), C-10 (RCCOW:Conference Party List message), C-11 (RCCOW:C/N_o and Link Test Results message), C-12 (RCCOW:Status Report A message), and C-14 (RCCOW:Guard List Report message). An assigned RCCOW message has priority over any other RCCOW message a terminal may have queued. An RCCOW assignment code can indicate that the next RCCOW time slot has been reserved for the exclusive use of a specified terminal for transmission of either a specific RCCOW message or the terminal's highest priority queued RCCOW message. When the RCCOW assignment code (see Table XI) indicates a specific RCCOW message type, the terminal shall transmit that RCCOW message in the next frame. If the requested RCCOW is not available or valid for this terminal version, the terminal shall transmit an RCCOW:Status Report A: Group 1 message. When the RCCOW assignment field contains the code for a Dedicated RCCOW (RCCOW assignment code = 00111), the terminal shall transmit the highest priority unsolicited RCCOW it has in queue (with the exception of an RCCOW:Conference Party List message which is only transmitted in response to a specific request from the channel controller) based on the priority rules described below. An RCCOW message not currently eligible for retransmission because the terminal is waiting for the acknowledgment from the CC or for an additional number of frames as specified in 5.2.1.2.3.5 may be transmitted in a dedicated time slot. If the terminal has no queued RCCOW message available for transmission, it shall transmit an RCCOW:Status Report A: Group 1 message.

5.2.1.2.3.2.2 Unsolicited RCCOW messages. Unsolicited RCCOW messages are those messages the terminal generates automatically as a result of an internal condition or by local initiative (such as an operator entry). When the RCCOW assignment code indicates an RCCOW precedence value (RCCOW assignment codes 00001 - 00101), any terminal may transmit any eligible RCCOW message of equal or higher precedence in the next frame. When the terminal has more than one RCCOW message in queue, only the highest priority RCCOW message is eligible for transmission. That is, no lower priority RCCOW shall be transmitted until the highest priority RCCOW is removed from queue as described in 5.2.1.2.3.3 and 5.2.1.2.3.4. For unsolicited RCCOW messages containing a Precedence field, the Precedence field value shall determine the priority of the message. For purposes of RCCOW transmission, the priority of RCCOW messages without a Precedence field is a function of message type. The RCCOW:Acknowledge Channel Control Request message and the RCCOW:Information Report message containing a Constant Key Alarm response code shall both be handled as if they had a precedence value of Emergency Action and a transmit priority higher than all other unsolicited RCCOW messages. The priority at which all other unsolicited RCCOW messages without a Precedence field shall be handled is determined by (a) the priority of other RCCOW messages in the queue, (b) terminal configuration, or (c) operator entry. If the queue contains no unsolicited RCCOW messages containing a Precedence field, the terminal configuration does not indicate a precedence, and the operator has not provided a precedence, then these unsolicited RCCOW messages shall be handled as if they had a precedence value of Routine. These conditions are discussed in the following three subparagraphs.

a. Priority determined by other RCCOW messages in queue. The terminal shall raise the precedence level of queued unsolicited RCCOW messages not containing a Precedence field to equal the level of the highest precedence queued unsolicited

RCCOW message containing a Precedence field. When the queue contains two or more RCCOW messages with equal precedence values, the transmission order shall be first-in-first-out within each precedence level. The precedence level of a queued RCCOW message can change as messages are added or removed from the queue. For example, when an RCCOW:Status Report B message is given a Routine precedence and queued prior to a Flash precedence RCCOW:Conference Request message, the RCCOW:Status Report B message inherits a precedence level of Flash and would have first-in-first-out priority over the RCCOW:Conference Request message. However, if the two RCCOW messages were queued in the opposite order, the RCCOW:Conference Request message would have the higher transmit priority. After the RCCOW:Conference Request message is removed from the queue, the precedence of the RCCOW:Status Report B message reverts to its previous precedence level of Routine.

b. Priority determined by terminal configuration. The terminal may provide a means for an operator to set precedence levels for the terminal to use for each unsolicited RCCOW message not containing a Precedence field. For example, the terminal could be configured to use a precedence level of Flash Override for an RCCOW:Information Report message generated in response to a CCOW:Information Request message. When an operator-configured precedence level has been set for a message type, the terminal shall associate that precedence level with the message type. The terminal shall raise the precedence level of the message when higher precedence unsolicited RCCOW messages containing a Precedence field are in the queue.

c. Priority determined by terminal operator. When an unsolicited RCCOW message not containing a Precedence field is operator initiated, the terminal may provide a means for an operator to provide a precedence level. When a precedence level is provided, the terminal shall associate that precedence level with the message. An operator-entered precedence level shall have priority over a terminal configured precedence for the message type. The terminal shall raise the precedence level of the message when higher precedence unsolicited RCCOW messages containing a Precedence field are in the queue.

5.2.1.2.3.3 Removing RCCOW messages from queue. With the exception of the RCCOW:Conference Party List message, RCCOW messages solicited by the CC via an RCCOW assignment shall be discarded after a single transmission attempt and shall not require acknowledgment. The RCCOW:Conference Party List message shall be retained indefinitely until acknowledged by the CC or until the RCCOW:Conference Request message that it is associated with has been canceled or disconnected. The RCCOW:Status Report A message shall be discarded after the first transmission but shall require acknowledgment to clear the contention report fields. Unsolicited RCCOW messages, including those sent in dedicated RCCOW time slots, shall be held in the queue until acknowledged by the CC, canceled by the operator, or discarded after completing the retransmission protocol. The RCCOW:Call Complete message shall also be removed from the queue if a CCOW:Slot Disconnect message is received for the port originating the RCCOW:Call Complete message.

5.2.1.2.3.4 Retransmission protocol. When the transmission of an unsolicated RCCOW message is not successful, the terminal shall determine when the RCCOW message is eligible for retransmission as specified in 5.2.1.2.3.5, below. Following any transmission attempt, the RCCOW is ineligible for retransmission while waiting for the acknowledgment from the CC and for an additional number of frames as specified in 5.2.1.2.3.5. Once the RCCOW is again eligible for retransmission, the terminal may wait up to 16 frames in an attempt to transmit the RCCOW message in a frame where the RCCOW precedence and frame precedence (as specified by the RCCOW assignment code) are equal or may transmit the RCCOW in the next frame where the RCCOW precedence is equal to or greater than the specified frame precedence. A CC may cycle through frame precedence levels to allow transmit opportunities for higher precedence RCCOWs. When such opportunities are being provided by the CC, the preceding processing options provide a way for terminals to wait for a frame with a higher precedence to reduce the possibility of contention with other terminals. If the terminal initiates a higher priority RCCOW message while a previously queued RCCOW is waiting to become eligible for retransmission, the retransmission attempt for the lower priority RCCOW shall be preempted. When the preempted RCCOW message again becomes the highest priority RCCOW queued, the terminal shall resume the retransmission attempt by first selecting a new backoff number. After the fifth unsuccessful transmission attempt, the RCCOW message shall be discarded.

5.2.1.2.3.5 RCCOW retransmission backoff number. The terminal shall use the retransmission backoff number to determine when the RCCOW will become eligible for retransmission. For the initial retransmission, the value of the retransmission backoff number is 4. For subsequent retransmissions, the value of the retransmission backoff number is 16, 32, and 64. The terminal shall derive a uniformly distributed random number U between 1 and the retransmission backoff number, inclusive. Starting in the next frame, the terminal begins to count the number of completed frames. When the count of completed frames equals U, the RCCOW becomes eligible for retransmission.

5.2.2 DC mode orderwire protocols and structure. The fields for each DC mode CCOW and RCCOW message are defined in 5.2.2.1 through 5.2.2.2, respectively.

5.2.2.1 CCOW in the DC mode. Fields common to all CCOWs, and all terminal actions required upon receipt are discussed in 5.2.2.1.1. The format of CCOW messages used in the DC mode is shown on Figures B-1, B-2, B-16, B-17, and B-18. In addition to receiving DC-mode CCOWs, if the terminal is required by its performance specification to have DC mode CC capability, the terminal shall also be capable of accepting inputs to compose and transmit the CCOW messages listed in Table XX. Fields unique to each CCOW message, and terminal actions required upon receipt, are discussed in 5.2.2.1.2.

TABLE XX. DC mode CCOW Command field codes.

CCOW MESSAGE	COMMAND CODE
Master Frame	None
No Command	00000
Spare	00001-01100
Information Request	01101
Zeroize	01110
Time-Slot Preparation	01111
Spare	10000-11111

5.2.2.1.1 Common CCOW fields. With the exception of the CCOW:Master Frame message, every CCOW message contains six common fields. The master frame, which does not contain a Command field, contains five common fields. The terminal shall be capable of receiving and processing the common fields in every CCOW message listed in Table XX. The terminal shall comply with the CCOW command in the frame following receipt of the CCOW. These fields are described below.

a. CALL ACK field (Bits 0-2, byte 1). The CC sets this field, as defined in Table XXI, to acknowledge receipt of RCCOW messages. The acknowledgment applies to the RCCOW message transmitted three frames earlier from the I/O port identified in the User Number field. Terminals shall use this field to determine if the CC received the RCCOW. The terminal requires acknowledgment for every RCCOW it transmits in the DC mode. See 5.2.2.3 for a description of the transmit decision processing and retransmit protocols for DC mode.

The terminal shall interpret the CALL ACK codes as follows:

1. No Acknowledgment (Code 000). No error-free RCCOW was received to be acknowledged. See 5.2.2.3 for description of RCCOW retransmit protocols.

2. Positive RCCOW CALL ACK (Codes 001 to 111). The RCCOW has been received. The User Number field identifies the terminal I/O port address whose RCCOW was received.

b. RCCOW Assignment field (Bits 3-7, byte 1). This field controls access to subsequent RCCOW time slots. The codes are defined in Table XXII. The RCCOW assignment will always be precedence level routine in the DC mode.

TABLE XXI. DC mode CALL ACK field definitions.

FIELD DEFINITION	CODE
No Acknowledgment	000
Positive RCCOW CALL ACK	001
Positive RCCOW CALL ACK	010
Positive RCCOW CALL ACK	011
Positive RCCOW CALL ACK	100
Positive RCCOW CALL ACK	101
Positive RCCOW CALL ACK	110
Positive RCCOW CALL ACK	111

TABLE XXII. DC mode RCCOW Assignment field definition.

FIELD DEFINITION	CODE
Not Allowed	00000-00100
RCCOW Precedence Routine	00101
Not Allowed	00110-11111

c. User Number field (Bits 0-5 and 7, byte 2; bits 0-7, byte 3; and bit 5, byte 7). This field identifies the terminal I/O port address to which the frame's CALL ACK is applicable. Bit 7, byte 2 is the MSB (bit 16) for all CCOW messages, except for the CCOW:Master Frame message. The CCOW:Master Frame message has only a 15-bit User Number field. All terminals with 16-bit addresses shall assume the MSB (bit 16) is a zero when receiving the CCOW:Master Frame message. Terminals with addresses containing a one as the MSB (bit 16) cannot get a positive CALL ACK in a CCOW:Master Frame message. Other assignment restrictions may apply to prevent address errors between terminals. Bit 5, byte 7 is the second MSB (bit 15) in all CCOWs with 1 exception: the CCOW:Master Frame message, with bit 15 being bit 6, byte 8.

d. Flag field (Bit 6, byte 2). This flag, when set to binary 1, identifies the frame as a master frame. The flag is set to binary 0 in all other frames.

e. Parity field (Bits 0-7, byte 5 and bits 0-7, byte 6). This field contains the 2-byte CRC derived as specified in 5.4.3.

f. Command field (Bits 0-4, byte 7). When the Flag field is set to binary 0, this field identifies which CCOW message is contained in this frame. When the Flag field is set to binary 1, this frame contains a CCOW:Master Frame message which does not contain a Command field. The CCOW messages and associated codes are listed in Table XX.

5.2.2.1.2 Unique CCOW message fields. The fields unique to each CCOW message are defined in 5.2.2.1.2.1 through 5.2.2.1.2.5. The CCOW:Master Frame and Time Slot Preparation messages are directed to all terminals. The other CCOW messages are directed to an I/O port (including terminal base address) or guard address. Terminals shall monitor the CCOW time slot and initiate actions as directed within the CCOW if the CCOW is directed to all terminals or if the terminal's I/O port or guard addresses match those in the Called party fields of the CCOW.

5.2.2.1.2.1 Master Frame (Figure B-1) (Command Field Code NONE). This CCOW is transmitted every eighth frame. The CCOW:Master Frame message contains data that updates orderwire, frame format, and KG status. If the Frame Format field in this CCOW changes the frame format from Format number 2 to Format number 1 (the B segment subformat changes to a value of 1 from any other value) or from Format number 1 to Format number 2 (the B segment subformat changes from a value of 1 to any other value) the terminal shall disconnect all slot connections located in all user segments and begin using the frame format specified in the Frame Format field in the next frame. The terminal shall interpret the data fields in this message as follows:

a. Precedence Cutoff (Bit 7, byte 2 and bits 0-1, byte 7). The precedence cutoff is always Routine (binary 110) in the DC mode (see Table XII).

b. Frame Format (Bits 0-7, byte 4 and bits 2-5, byte 7). This non-contiguous 12-bit field is subdivided into three 4-bit subfields, each of which contains a HEX number, identifying which frame subformats will be used on each 25-kHz user segment starting in the next frame. If the frame subformats have not changed from the previous master frame, no terminal action is required. If any of the frame subformats have changed, the terminal will disconnect all slot connections that existed in the changed segment(s) of the frame format. When changing from Format number 1 to Format number 2 or from Format number 2 to Format number 1, all slot connections in all user segments will be disconnected.

c. KG Memory (Bits 6-7, byte 7 and bit 7, byte 8). This field identifies the KG memory location in use.

d. KG Net Number (Bits 0-4, byte 8). This field identifies the KG net number in use. The DC mode channel controller sets this field to the value of the channel frequency code.

e. KG Day (Bits 5-7, byte 9). This field identifies the KG day of the week.

f. Frame Count (Bits 0-4, byte 9; bits 0-7, byte 10; and bits 0-7, byte 11). This field identifies the frame count of the current frame.

g. DC Flag (Bit 5, byte 8). This flag identifies whether the channel is operating in the AC or DC mode. If the flag is set to binary 0, the channel operates in the AC mode. If the flag is set to binary 1, the channel operates in the DC mode.

h. Scrambled CC KG ID (Bits 0-7, byte 12 and bits 0-7, byte 13). This field identifies the scrambled CC KG ID number of the CC required for CCOW decryption (see 5.3.1, 5.3.2.1, and 5.3.2.2).

5.2.2.1.2.2 No Command (Figure B-2) (Command field code 00000). The CC sends this CCOW when there is no other CCOW message to be sent in a frame. The terminal shall ignore all but the six common fields in this CCOW.

5.2.2.1.2.3 Information Request (Figure B-16) (Command Field Code 01101). This CCOW message has two purposes, as defined in 5.2.1.1.2.15.1 and 5.2.1.1.2.15.2. The terminal shall interpret the data fields in this message as defined in 5.2.1.1.2.15.

5.2.2.1.2.4 Zeroize (Figure B-17) (Command Field Code 01110). This CCOW message directs a terminal to zeroize the orderwire KG key storage memories and disconnect all slot connects. The terminal shall interpret the data fields in this message as defined in 5.2.1.1.2.16.

5.2.2.1.2.5 Time-Slot Preparation (Figure B-18) (Command Field Code 01111). This CCOW message directs all terminals on an rf channel to change the manner in which they prepare their KGs for encryption and decryption of orderwire messages. Table XV describes all combinations of KG parameters possible. CC directed KG parameter changes are accomplished by transmitting a binary 1 in the fields noted in Table XV. The terminal shall interpret the data fields in this message as defined in 5.2.1.1.2.17.

5.2.2.2 RCCOW in the DC mode. Two different RCCOW messages can be sent in DC mode. The RCCOW:Data Transfer message (Figures C-2 and C-3) is optional and the RCCOW:Information Report message (Figure C-7) shall be mandatory. If the terminal is required by its equipment specification to implement the RCCOW:Data Transfer message, it shall be capable of both sending and receiving this message. Data field definitions and terminal actions shall be the same as those given for the AC mode (see 5.2.1.2.1, 5.2.1.2.2.2, and 5.2.1.2.2.6), with the exception of those fields labeled *AC mode only*. These AC mode fields shall be set to binary 0 for the DC mode.

5.2.2.3 RCCOW transmit decision in the DC mode. If a terminal has one or more RCCOWs available for transmission, the determination of whether to transmit an RCCOW and the selection of the RCCOW to transmit depends on the factors described in 5.2.2.3.1 through 5.2.2.3.5.

5.2.2.3.1 Transmit enable. The terminal shall not transmit an RCCOW message if (1) a transmit inhibit condition exists (may be imposed by the terminal operator), (2) range lock has been lost (see 5.1.4 a), or (3) the previous CCOW was not received error free (see 4.8).

5.2.2.3.2 RCCOW priority. RCCOW messages may be unsolicited or solicited by the CC; that is, in response to a CCOW:Information Request message from the CC. The determination of whether to transmit an RCCOW message in the next frame and the selection of the RCCOW message to transmit depends on whether the RCCOW is unsolicited or solicited, the type of unsolicited message, and the retransmit eligibility of any queued RCCOW messages. For a discussion of retransmit eligibility, see 5.2.2.3.4.

5.2.2.3.2.1 Solicited RCCOW messages. An RCCOW:Information Report message that the terminal generates in response to a CCOW:Information Request message shall be transmitted before any other RCCOW message a terminal has in queue.

5.2.2.3.2.2 Unsolicited RCCOW messages. Unsolicited RCCOW messages are those RCCOW:Information Report or RCCOW:Data Transfer messages the terminal generates automatically as a result of an internal condition or by local initiative (such as an operator entry). The two DC mode RCCOW messages have an equal message precedence of Routine; however, the RCCOW:Information Report message containing a Constant Key Alarm response code 200 shall be transmitted before all other unsolicited RCCOW messages. When the terminal has more than one RCCOW message queued, only the highest priority RCCOW message is eligible for transmission. The highest priority RCCOW in queue becomes eligible for a first transmission attempt in the current frame. When the queue contains two or more RCCOW messages with equivalent transmit priorities, the transmission order shall be first-in-first-out within each priority level.

5.2.2.3.3 Removing RCCOW messages from queue. RCCOW messages shall be retained in the queue until acknowledged by the

CC, canceled by the operator, or discarded by the retransmission protocol.

5.2.2.3.4 Retransmission protocol. When a transmission attempt is not successful, the terminal shall determine when to retransmit as specified in 5.2.2.3.5. Following any transmission attempt, the RCCOW is ineligible for retransmission while waiting for the acknowledgment from the CC and for an additional number of frames as determined in 5.2.2.3.5. If the terminal generates a higher priority RCCOW message while a previously queued RCCOW is waiting to be retransmitted, the retransmission attempt for the lower priority RCCOW shall be preempted. When the preempted RCCOW message again becomes the highest priority RCCOW queued, the terminal shall resume the retransmission attempt by first selecting a new backoff number. After the fifth unsuccessful transmission attempt, the RCCOW message shall be discarded.

5.2.2.3.5 RCCOW retransmission backoff number. To determine the frame in which to retransmit, the terminal shall use the retransmission backoff number. For the initial retransmission, the value of the retransmission backoff number is 4. For subsequent retransmissions, the value of the retransmission backoff number is 16, 32, and 64. The terminal shall derive a uniformly distributed random number U between 1 and the retransmission backoff number, inclusive. Starting in the next frame, the terminal begins to count an accumulated number of completed frames. When the count of completed frames equals the number U, the RCCOW is eligible for retransmission.

5.2.2.4 Link test in DC mode. Terminals may access the link test time slot in odd-numbered frames for evaluation of link quality. The terminal shall be capable of performing link tests at burst rates of 9.6, 19.2, and 16 ksps. Link tests shall be locally initiated (such as, but not limited to, operator entry). Terminals shall not start a link test if another terminal is already performing a link test. Terminal system specifications should define how the terminal provides access to the results of the link test.

5.3 Orderwire processing. The terminal shall be capable of processing both plain-text and encrypted orderwire messages. Either all orderwire messages shall be encrypted or none shall be. Encryption and decryption shall be accomplished with the COMSEC/TRANSEC Integrated Circuit (CTIC) or alternative NSA-approved device that is cryptographically and functionally compatible with the CTIC operating in Mode C as specified in NSA specification 88-4. Hardware implementation of the terminal shall include provisions for future implementation of Over-the-Air Rekeying (OTAR) for the orderwire. All terminals shall perform CCOW receive processing and RCCOW transmit processing. Terminals with DC mode CC capability shall perform CCOW transmit processing and RCCOW receive processing. A terminal required by its specification to implement the RCCOW:Data Transfer message shall be capable of both sending and receiving this message. CRC generation shall be as specified in 5.4.3. Terminals shall process orderwires so that the results are identical to those produced in 5.3.1 and 5.3.2.

5.3.1 Plain-text (unencrypted) Orderwire processing. All terminals shall comply with paragraphs 5.3.1.2 and 5.3.1.3. In addition, terminals that are required by their specification to perform a CC function shall comply also with 5.3.1.1. Terminals required to receive RCCOW messages shall comply with 5.3.1.4.

5.3.1.1 Plain-text CCOW transmission. Processing for transmission of plain-text CCOWs is as follows:

a. Format the CCOW message (bytes 1 through 13) to be transmitted.

b. For CCOW:Master Frame messages, place the terminal base address in the Scrambled CC KG ID field (bytes 12 and 13).

c. Set the Parity field (bytes 5 and 6) to binary 0.

d. Generate a CRC on the CCOW message. Place the CRC into the CCOW message Parity field [bytes 5 (high-order CRC byte) and 6 (low-order CRC byte)].

e. Continue transmit processing of the CCOW message.

5.3.1.2 Plain-text CCOW reception. Processing for reception of all plain-text CCOWs is as follows:

a. After demodulation, deinterleaving, and decoding, store the received 13-byte CCOW message.

b. Store separately the CCOW message Parity field (bytes 5 and 6).

c. Set the Parity field (bytes 5 and 6) in the message stored in step a, above, to binary 0.

d. Generate a CRC on the CCOW message.

e. Compare the calculated CRC with the CRC stored in step b, above. If they do not match, discard the CCOW.

f. If the CRCs match, continue CCOW processing.

5.3.1.3 Plain-text RCCOW transmission. Processing for transmission of plain-text RCCOWs is as follows:

a. Format the RCCOW message (bytes 1 through 13) to be transmitted.

b. Set the Scrambled Terminal KG ID field (bytes 1 and 2) and the Parity field (bytes 12 and 13) to binary 0.

c. Generate a CRC on the RCCOW message. Place the CRC into the Parity field [bytes 12 (high-order CRC byte) and 13 (low-order CRC byte)].

d. Continue transmit processing of the RCCOW message.

5.3.1.4 Plain-text RCCOW reception. Processing for reception of plain-text RCCOWs is as follows:

a. After demodulation, deinterleaving, and decoding, store the received 13-byte RCCOW message.

b. Store separately the Parity field (bytes 12 and 13).

c. In the message stored in step a, above, set the Parity field (bytes 12 and 13) to binary 0.

d. Generate a CRC on the RCCOW message.

e. Compare the calculated CRC with the CRC stored in step b, above. If they do not match, discard the RCCOW.

f. If the CRCs match, continue RCCOW processing.

5.3.2 Cipher-text (encrypted) Orderwire processing.

5.3.2.1 Cipher-text CCOW transmission. The encryption process varies depending on whether the CCOW is for the master frame or a non-master frame. This paragraph and its subparagraphs shall be applicable to terminals that are required by their specification to perform a CC function.

5.3.2.1.1 CCOW:Master Frame message encryption processing. The CCOW:Master Frame message is encrypted in a mode that protects the CC KG ID number. The CC generates a scrambled KG CC ID number upon initialization as a CC. Following initialization, the scrambled CC KG ID number in use is replaced with a new value at random intervals. The number of master frames between each replacement is determined by selecting a pseudorandom number between 128 and 16,384. The most recently generated scrambled KG ID number is used by the CC for subsequent CCOW message encryptions and transmissions until replaced by a new value.

5.3.2.1.1.1 CCOW:Master Frame message encryption with a newly generated scrambled CC KG ID number. The method used by the CC to generate a new scrambled CC KG ID and encrypt the

CCOW:Master Frame messages will result in an output identical to that obtained from the following sequence.

a. Format the CCOW message (bytes 1 through 13) to be transmitted and store it.

b. Set the Parity field (bytes 5 and 6) and Scrambled CC KG ID field (bytes 12 and 13) to binary 0.

c. Generate a CRC on the CCOW message. Place the CRC into the Parity field [bytes 5 (high-order CRC byte) and 6 (low-order CRC byte)].

d. Initialize the CTIC to perform Mode C Encrypt Unique Scrambled ID Number Initialization as specified in NSA 88-4. The CC KG ID number is input to the CTIC (LSB first) prior to initialization.

e. Input the Time Slot Number (TSN) to the CTIC as specified in NSA 88-4. The TSN is as specified in 5.3.3. The scrambled CC KG ID number is retrieved from the CTIC and stored for use in future CCOW encryptions (until replaced by a newly generated scrambled CC KG ID number).

f. Serially input the formatted CCOW:Master Frame message, as modified in steps b and c, above, to the CTIC beginning with byte 1, LSB, and ending with byte 13, MSB.

g. Retrieve the encrypted CCOW message from the CTIC.

h. Replace bits 6 and 7 of byte 7 and all bits of bytes 8, 9, 10, and 11 of the encrypted CCOW message with their corresponding bits from the plain-text message stored in a, above.

i. Retrieve the scrambled CC KG ID number stored in step e, above, and insert it into the Scrambled CC KG ID field [bytes 12 (MSBs) and 13 (LSBs)] of the encrypted CCOW message.

j. Continue transmit-processing of the CCOW message.

5.3.2.1.1.2. CCOW:Master Frame message encryption with a previously generated scrambled CC KG ID number. The method used by the CC to encrypt the CCOW:Master Frame message using a previously generated scrambled CC KG ID number will result in an output identical to that obtained from the following sequence.

a. Format the CCOW message (bytes 1 through 13) to be transmitted and store it.

b. Set the Parity field (bytes 5 and 6) and Scrambled CC KG ID field (bytes 12 and 13) to binary 0.

c. Generate a CRC on the CCOW message. Place the CRC into the Parity field [bytes 5 (high-order CRC byte) and 6 (low-order CRC byte)].

d. Initialize the CTIC to perform Mode C Encrypt Unique Unscrambled ID Number Initialization. The most recently generated scrambled CC KG ID number (see 5.3.2.1.1.1 e) is input to the CTIC (LSB first) for this encryption process prior to initialization.

e. Input the TSN to the CTIC, as specified in NSA 88-4. The TSN will be as specified in 5.3.3.

f. Serially input the formatted message as modified in steps b and c, above, to the CTIC beginning with byte 1, LSB, and ending with byte 13, MSB.

g. Retrieve the encrypted CCOW message from the CTIC.

h. Replace bits 6 and 7 of byte 7 and all bits of bytes 8, 9, 10, and 11 of the encrypted CCOW message with their corresponding bits from the plain-text message stored in a, above.

i. Retrieve the scrambled CC KG ID number (the same number as used in step d, above) and insert it into the Scrambled CC KG ID field [bytes 12 (MSBs) and 13 (LSBs)] of the encrypted CCOW message.

j. Continue transmit-processing of the CCOW message.

5.3.2.1.2. Non-master frame CCOW encryption. The method used by the CC to encrypt non-master frame CCOW messages will result in an output identical to that obtained from the following sequence.

a. Format the CCOW message (bytes 1 through 13) and store it.

b. Set the Parity field (bytes 5 and 6) to binary 0.

c. Generate a CRC on the CCOW message. Place the generated CRC into the Parity field [bytes 5 (high-order CRC byte) and 6 (low-order CRC byte)].

d. Initialize the CTIC to perform Mode C Encrypt Unique Unscrambled ID Number Initialization. The most recently generated scrambled CC KG ID number (see 5.3.2.1.1.1 e) is input to the CTIC (LSB first) for this encryption process prior to initialization.

e. Input the TSN to the CTIC, as specified in NSA 88-4. The TSN shall be as specified in 5.3.3.

f. Serially input the formatted non-master frame CCOW message as modified in steps b and c, above, to the CTIC beginning with byte 1, LSB, and ending with byte 13, MSB.

g. Retrieve the encrypted CCOW message from the CTIC.

h. Continue transmit-processing of the CCOW message.

5.3.2.2 Cipher-text CCOW reception. The method used by the terminal to decrypt the CCOW messages shall result in an output identical to that obtained from the following subparagraphs. The decryption process varies depending on whether or not a master frame or non-master frame CCOW is being decrypted.

5.3.2.2.1. CCOW:Master Frame message decryption.

a. After demodulation, deinterleaving, and decoding, store the received, encrypted 13-byte CCOW message.

b. Read the scrambled CC KG ID number from the CCOW message received in a, above, and store it in a separate memory location.

c. Initialize the CTIC to perform Mode C Decrypt Unique Synchronization.

d. Input the scrambled CC KG ID number (LSB first) stored in b, above, and the TSN to the CTIC as specified in NSA 88-4. The TSN will be as specified in 5.3.3.

e. Serially input the received message stored in a, above, to the CTIC beginning with byte 1, LSB, and ending with byte 13, MSB.

f. Retrieve the decrypted message from the CTIC and store it.

g. Reformat the stored decrypted message by replacing bits 6 and 7 of byte 7, and all bits of bytes 8, 9, 10, and 11 with the corresponding bits of the encrypted CCOW message stored in a, above.

h. Store the decrypted Parity field (bytes 5 and 6).

i. Set the Parity field (bytes 5 and 6) and the Scrambled CC KG ID field (bytes 12 and 13) of the decrypted CCOW message to binary 0.

j. Generate a CRC on the decrypted CCOW message.

k. Compare the calculated CRC with the CRC stored in step h, above.

l. If the CRCs match, copy the scrambled CC KG ID number stored in step b, above, to another location and continue processing the CCOW. This scrambled CC KG ID number is used to decrypt succeeding non-master frame CCOWs. If the CRCs do not match, discard the CCOW.

5.3.2.2.2. Non-master frame CCOW decryption. The terminal decrypts non-master frame CCOWs as follows:

a. After demodulation, deinterleaving, and decoding, store the received, encrypted 13-byte CCOW message.

b. Initialize the CTIC to perform Mode C Decrypt Unique Synchronization.

c. Retrieve the scrambled CC KG ID number that was received in the last valid CCOW:Master Frame message (stored in 5.3.2.2.1 l). Input this scrambled CC KG ID number (LSB first) and the TSN to the CTIC as specified in NSA 88-4. The TSN will be as specified in 5.3.3.

d. Serially input the received non-master frame CCOW message stored in a, above, to the CTIC beginning with byte 1, LSB, and ending with byte 13, MSB.

e. Retrieve the decrypted non-master frame CCOW message from the CTIC and store it.

f. Store the decrypted Parity field (bytes 5 and 6).

g. Set the Parity field (bytes 5 and 6) of the decrypted CCOW message stored in step e, above, to binary 0.

h. Generate a CRC on the decrypted CCOW message.

i. Compare the calculated CRC with the CRC stored in step f, above.

j. If they match, continue processing the CCOW. If they do not match, discard the CCOW.

5.3.2.3. Cipher-text RCCOW transmission. Processing for transmission of all cipher-text RCCOWs shall result in an output identical to that obtained from the following processing sequence.

a. Format the RCCOW message (bytes 1 through 13) to be transmitted.

b. Set the Scrambled Terminal KG ID field (bytes 1 and 2) and the Parity field (bytes 12 and 13) to binary 0.

c. Generate a CRC on the RCCOW message. Place the generated CRC into the Parity field [bytes 12 (high-order CRC byte) and 13 (low-order CRC byte)].

d. Initialize the CTIC to perform Mode C Encrypt Unique Scrambled ID Number Initialization. The terminal KG ID number is input (LSB first) to the CTIC for this encryption process prior to initialization.

e. Input the TSN to the CTIC as specified in NSA 88-4. The TSN will be as specified in 5.3.3. Retrieve the scrambled terminal KG ID number from the CTIC and store it.

f. Serially input the formatted RCCOW message as modified in steps b and c, above, to the CTIC beginning with byte 3, LSB, and ending with byte 13, MSB.

g. Retrieve the encrypted RCCOW message from the CTIC.

h. Retrieve the scrambled terminal KG ID number (as stored in step e, above) and insert it into the encrypted RCCOW message Scrambled Terminal KG ID field [bytes 1 (MSBs) and 2 (LSBs)].

i. Continue transmit-processing of the RCCOW message.

5.3.2.4. Cipher-text RCCOW reception. This paragraph shall be applicable to terminals that are required by their specification to perform a CC function or to receive and process cipher-text RCCOWs and results in an output identical to that obtained from the steps below.

a. After demodulation, deinterleaving, and decoding, store the received, encrypted 13-byte RCCOW message.

b. Initialize the CTIC to perform Mode C Decrypt Unique Synchronization.

c. Input the TSN and scrambled terminal KG ID number (LSB first) to the CTIC as specified in NSA 88-4. The TSN will be as specified in 5.3.3. The scrambled terminal KG ID number is bytes 1 and 2 from the RCCOW message received in step a, above.

d. Serially input the received RCCOW message stored in step a, above, to the CTIC for decryption beginning with byte 3 (LSB) and ending with byte 13 (MSB).

e. Retrieve the decrypted RCCOW from the CTIC and store it.

f. Store the decrypted Parity field (bytes 12 and 13).

g. Set to binary 0 all bits of the stored, decrypted RCCOW message Scrambled Terminal KG ID field (bytes 1 and 2) and Parity field (bytes 12 and 13).

h. Generate a CRC on the message.

i. Compare the calculated CRC with the CRC stored in step f, above. If they do not match, discard the RCCOW. If they match, continue RCCOW processing.

5.3.3. Time Slot Number (TSN) format. Regardless of message type (Master Frame CCOW, non-master frame CCOW, or RCCOW), the CTIC must use the TSN for proper encryption or decryption. The TSN contains 39 bits and is divided into four fields: KG Net Number (7 bits where the two MSBs are set to zero), KG Day (3 bits), Frame Count (21 bits), and the RCCOW/CCOW fields. The TSN structure is shown in Figure 10. Bits 0, 4, 25, 29, and 32 are LSBs in their respective fields. KG Net Number, KG Day, and Frame Count are transmitted unencrypted in every CCOW:Master Frame message (see 5.2.1.1.2.1). The KG Net Number, KG Day, and Frame Count received in a CCOW:Master Frame message shall be used in the decryption of that Master Frame message. If the decryption of that CCOW:Master Frame message is successful as indicated by a matching CRC, the KG Net Number and KG Day fields shall be stored and used for decrypting the seven succeeding non-Master frame CCOWs. These fields are also used for all RCCOW encryptions and decryptions for the Master Frame Epoch. If the decryption of that CCOW:Master Frame message is not successful, the terminal shall use the KG Net Number and KG Day fields (along with the value from the Scrambled CC KG ID field) from the last successful CCOW:Master Frame message decryption in an attempt to formulate a TSN for decrypting the succeeding non-Master frame CCOW messages. During the process of CCOW acquisition, all received CCOW messages are decrypted using the master frame decryption process until a matching CRC is achieved.

38 32	31 29	28 25	24 4	3	2 0
KG Net #	KG DAY	0000	Frame Count	R	000

NOTE: R = 0 for CCOW and 1 for RCCOW.

FIGURE 10. 25-kHz Time Slot Number (TSN) format.

a. KG Net Number (Bits 32-38). The 2 MSBs, bits 37 and 38 in this field, are always set to binary 0. The remaining 5 bits (TSN bits 32 through 36) are transmitted unencrypted in the CCOW:Master Frame message and are located in bits 0 through 4 of byte 8, as shown in Figure B-1. The terminal shall use the bits in the KG Net Number field received in the CCOW:Master Frame Message to build the TSN.

b. KG Day (Bits 29-31). The KG Day is transmitted unencrypted in the CCOW:Master Frame message in bits 5, 6, and 7 of byte 9, as shown in Figure B-1. A value of binary 000 in the KG Day field indicates a daily cryptographic period. Values of binary 001 through 111 in the KG Day field indicates a weekly cryptographic period.

c. Frame Count (Bits 4-24). The Frame Count is transmitted unencrypted in the CCOW:Master Frame message in bits 0 through 4 of byte 9 and all bits of bytes 10 and 11. The Frame Count, a 21-bit binary number, is increased by 1 at the beginning of each frame. The three least significant bits of the frame count (bits 4, 5, and 6 of the TSN) are all zeros for a CCOW:Master Frame message.

d. RCCOW/CCOW (Bit 3). This field is set to a binary 0 to encrypt/decrypt a CCOW message and set to a binary 1 to encrypt/decrypt an RCCOW message.

5.4 Error control.

5.4.1 FEC coding. Baseband data shall be presented to the FEC encoder in the order it is received from the baseband equipment. Baseband data bit number one shall be the first data bit sent into the encoder. The thirteen 8-bit bytes of the orderwire shall be presented to the FEC encoder in the following order: LSB of byte 1 through most significant bit (MSB) of byte 1, LSB of byte 2 through MSB of byte 2, · · ·, LSB of byte 13 through MSB of byte 13. Eight bits (all binary 0) shall then be presented to the FEC encoder to flush the encoder and result in a total of 224 bits (one interleaver block pair) out of the encoder.

FEC coding rates for each user communications I/O data rate shall be as defined in Table XXIII. The modulation rates applicable for each of the coding rates shall be as specified in Tables A-II through A-V. Fill bits as shown in Tables A-II through A-V shall be added to complete a 112-bit interleaver block and to flush the encoder.

The output of the encoder shall be identical with the output of a rate 1/2, constraint length 7, or rate 3/4 constraint length 9, convolutional encoder shown on Figure 11 and defined in 5.4.1 a. Rate 3/4 and 7/8 codes used on 5-kHz slave channels shall be implemented as punctured codes described in 5.4.1 b. CCOW and RCCOW transmissions shall use rate 1/2, K = 7 FEC coding. Range and link test transmissions shall not use FEC coding. The code rate employed for each designated user time slot shall be as specified in Figures A-1 through A-4.

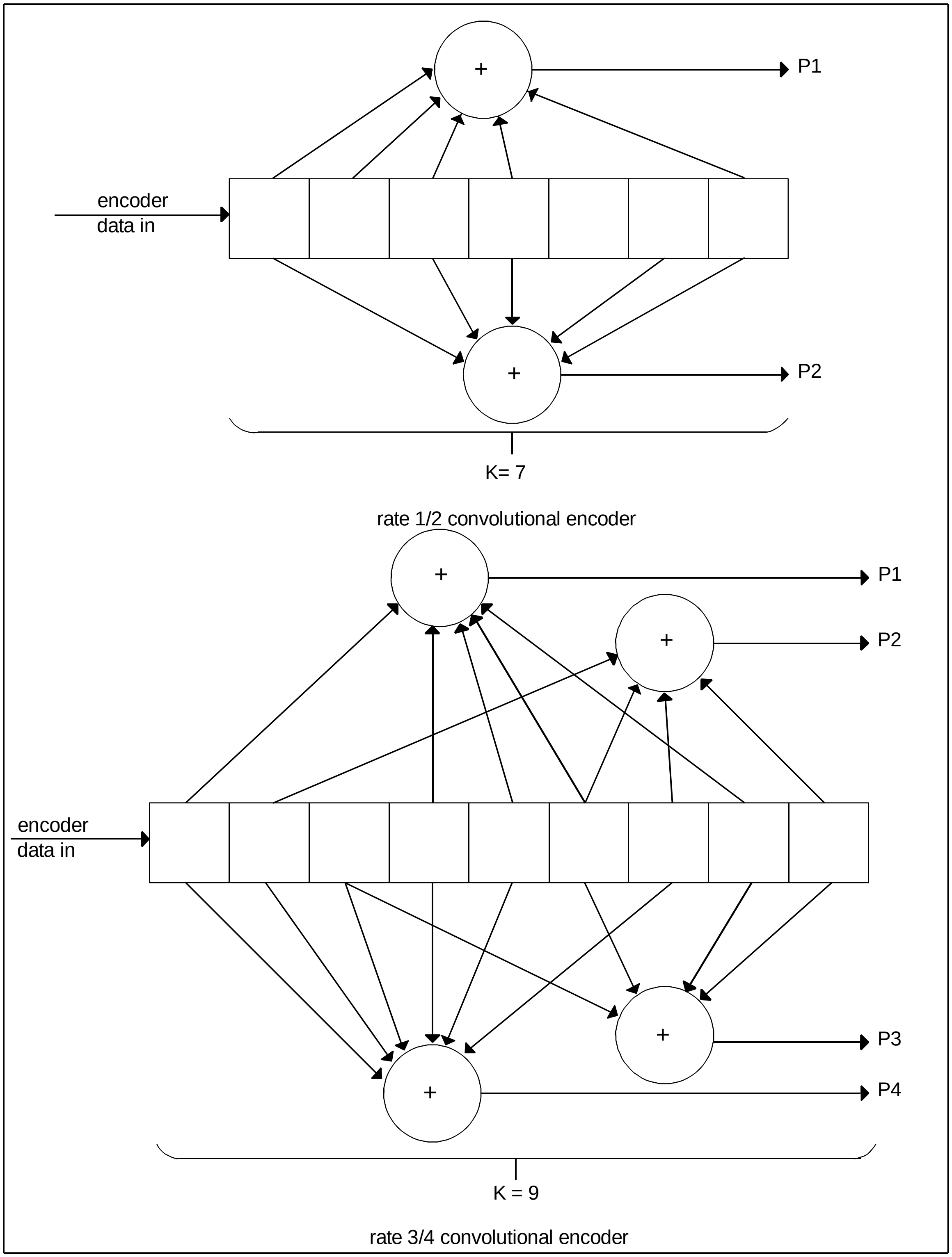


FIGURE 11. Convolutional encoder tap positions.

TABLE XXIII. User data rate versus code rate.

DATA RATE	CODE RATE, K = 7				CODE RATE, K = 9
	1/2	3/4 *	7/8 *	1 *	3/4 **
75	X				
300	X				X
600	X				
1200	X	X			X
2400	X	X	X	X	X
4800	X	X	X	X	X
16000					X

NOTE:
* Applies only to 5-kHz slave channels.
** Applies only to 25-kHz channels.

a. FEC characteristics. The code tap positions are as follows:

Rate = 1/2 K = 7
P1 1111001
P2 1011011

Rate = 3/4 K = 9
P1 100111010
P2 010001101
P3 001001011
P4 111110100

NOTE: The MSB is farthest left, and the LSB is farthest right.

b. Punctured forward error correction codes. The rate 3/4 and 7/8 codes employing constraint length 7 encoders, used for 5-kHz channel communications time slots, are constructed from the rate 1/2 code by a technique known as puncturing. To construct these higher rate codes, the terminal shall delete specific bits from the rate 1/2 encoder outputs, P1 and P2, using the puncture patterns shown in Table XXIV. The terminal shall transmit only those bits identified with a 1 in Table XXIV. Prior to decoding the received sequence, the receiving terminal shall insert erasure bits in place of the bits that were deleted. For 2400 bps data using rate 7/8 punctured coding, the last interleaver block will contain only four of the six flush bits. The receiving terminal shall add a sufficient number of erasure bits to the end of these received bursts to complete the error correction process.

TABLE XXIV. Punctured code patterns.

CODE RATE	SYMBOL	PUNCTURED PATTERN (0 = DELETED BIT)
3/4	P1:	101
	P2:	110
7/8	P1:	1000101
	P2:	1111010

5.4.2 Interleaver random structure generation. The block interleaver structure shall consist of 2 independently constructed blocks of 112 bits each used in sequence. The interleaving process shall be equivalent to writing input bits into the 112-bit blocks sequentially as shown in the input order columns of Tables XXV and XXVI and read out in the sequence dictated by the output order columns of the tables. For example, the first three bits written into the interleaver, input order 0,1, and 2, are read from the interleaver in positions 19, 61, and 86. Likewise, the first three bits read from the interleaver block, output order 0, 1, and 2, are the bits written into the interleaver block in positions 70, 46, and 62. Deinterleaving shall reverse this operation. Interleaver boundaries shall start at the beginning of the Data field within each burst (see Figure 1) with the first interleaved bit of the burst in the first position defined by the block of Table XXV. Note that each burst contains an even integer number of interleaver blocks [i.e., the combination of block 1 (see Table XXV) and block 2 (see Table XXVI) is referred throughout this document as an interleaver block pair].

5.4.3 Orderwire cyclic redundancy check. In addition to convolutional encoding and interleaving, orderwires shall undergo 2-byte CRCs on their 13 bytes. The parity bytes shall be sent within the structure of each orderwire. The parity of a received orderwire message shall be recalculated and compared to the received parity. If the parities do not match, the orderwire shall be discarded; otherwise, it shall be processed. To encode the message polynomial $G(x)$ using a generator polynomial $P(x)$ of order n, $G(x)$ shall first be multiplied by x^n. The result shall be divided by $P(x)$ to form both the quotient $Q(x)$ and the remainder $R(x)$. The code polynomial $F(x)$ is the product of the generator polynomial and the quotient where

$$x^n\,G(x) = Q(x)\,P(x) + R(x)$$

$$P(x)\,'\,X^{16}\%X^{15}\%X^{2}\%1$$

TABLE XXV. Interleaver sequence--block 1.

INPUT ORDER	OUTPUT ORDER	INPUT ORDER	OUTPUT ORDER	INPUT ORDER	OUTPUT ORDER	INPUT ORDER	OUTPUT ORDER
0	19	28	22	56	4	84	69
1	61	29	85	57	60	85	84
2	86	30	32	58	108	86	13
3	49	31	106	59	68	87	43
4	94	32	73	60	44	88	93
5	25	33	23	61	52	89	103
6	87	34	3	62	2	90	77
7	34	35	88	63	110	91	64
8	9	36	96	64	72	92	15
9	50	37	28	65	10	93	24
10	107	38	79	66	35	94	89
11	99	39	41	67	53	95	75
12	8	40	59	68	97	96	33
13	40	41	11	69	62	97	47
14	111	42	70	70	0	98	5
15	74	43	42	71	81	99	95
16	65	44	21	72	12	100	57
17	45	45	29	73	109	101	46
18	14	46	1	74	91	102	7
19	83	47	101	75	20	103	82
20	30	48	90	76	51	104	56
21	48	49	16	77	6	105	38
22	58	50	80	78	37	106	102
23	100	51	54	79	63	107	76
24	26	52	67	80	78	108	66
25	39	53	27	81	55	109	17
26	71	54	105	82	18	110	36
27	104	55	92	83	31	111	98

TABLE XXVI. Interleaver sequence--block 2.

INPUT ORDER	OUTPUT ORDER	INPUT ORDER	OUTPUT ORDER	INPUT ORDER	OUTPUT ORDER	INPUT ORDER	OUTPUT ORDER
112	116	140	203	168	131	196	195
113	140	141	137	169	166	197	215
114	193	142	129	170	177	198	125
115	156	143	180	171	123	199	164
116	214	144	219	172	223	200	112
117	171	145	209	173	208	201	172
118	205	146	190	174	144	202	220
119	113	147	160	175	114	203	206
120	181	148	198	176	122	204	158
121	128	149	118	177	134	205	192
122	221	150	212	178	162	206	174
123	211	151	141	179	154	207	145
124	120	152	173	180	202	208	153
125	196	153	161	181	191	209	216
126	147	154	204	182	218	210	207
127	182	155	126	183	124	211	127
128	139	156	143	184	136	212	184
129	115	157	217	185	178	213	175
130	152	158	167	186	151	214	142
131	165	159	157	187	119	215	121
132	187	160	133	188	138	216	200
133	176	161	148	189	130	217	168
134	201	162	213	190	170	218	183
135	210	163	197	191	155	219	149
136	150	164	169	192	194	220	199
137	132	165	222	193	135	221	163
138	189	166	188	194	185	222	186
139	179	167	146	195	159	223	117

Since, in modulo 2 arithmetic, addition and subtraction are the same,

$$F(x) = Q(x)P(x) = x^n G(x) + R(x)$$

where

$R(x)$ = parity bits

This CRC method is the IBM Binary Synchronous Communications (BSC) CRC-16 Protocol (GA27-3004, see 2.3). The CRC shall be calculated on the thirteen byte orderwire messages beginning with byte 13, LSB, and ending with byte 1, MSB. The locations that the CRC will occupy in CCOW and RCCOW messeages shall be set to binary 0 during the CRC calculation. The binary 0 data shall be replaced by the calculated CRC before the message is transmitted.

5.5 Modulation.

5.5.1 25-kHz modulation.

5.5.1.1 Modulation formats. The modulation employed on all 9.6-ksps and 19.2-ksps burst symbol rate transmissions, including preamble, shall be binary phase-shift keying (BPSK). The modulation employed on all 16 ksps burst symbol rates, except preamble, shall be differentially encoded quadrature phase-shift keying (DEQPSK). The preamble field modulation for the 16-ksps burst rates shall be quadrature phase-shift keying (QPSK).

a. **BPSK modulation.** BPSK modulation is represented by

$$S(t) = A\cos\theta(t)\sin\omega_o t + A\sin\theta(t)\cos\omega_o t = A\sin\left[\omega_o t + \theta(t)\right]$$

where

$\theta(t)$ = $\pm\pi/2$ radians, and the phase-shift changes with each new data bit of duration T

b. **DEQPSK modulation.** The data bit-mapping in the modulation process for DEQPSK shall be the Gray code-mapping convention defined in Table XXVII. The phase state is referenced to the carrier phase.

5.5.1.2 Modulation rates. The terminal shall burst at 9.6 ksps or 19.2 ksps using BPSK modulation, and 16 ksps using DEQPSK modulation.

5.5.1.3 Adjacent channel emissions. In a nominal 25-kHz bandwidth whose center frequency is displaced by $\pm\Delta f$ from the terminal's transmit carrier frequency, the eirp shall be as specified in 5.5.1.3.1 and 5.5.1.3.2.

TABLE XXVII. Modulation bit-mapping.

INPUT DATA PAIR TO MODULATOR		PHASE ADVANCE	
I	**Q**	**radians**	**degrees**
0	0	0	0
0	1	B/2	90
1	1	B	180
1	0	3 B/2	270

5.5.1.3.1 Relative adjacent channel emissions. The EIRP, relative to the terminal's total output EIRP, shall not exceed the relative EIRP values specified in Table XXVIII. These values shall apply when the transmitter carrier frequency is either unmodulated or modulated.

TABLE XXVIII. 25-kHz allowable adjacent channel emmissions (ACE)

ªf (kHz)	Relative EIRP (dB) (EIRP<+18dBW)			MAXIMUM EIRP (EIRP$+18dBW)
	9.6 ksps BPSK (dB)	**19.2 ksps BPSK (dB)**	**16 ksps DEQPSK (dB)**	**All Rates**
25	-14.1	-12.6	-14.2	+5.4
50	-22.1	-19.6	-18.9	-0.9
75	-25.7	-21.7	-23.8	-3.7
100	-27.7	-24.9	-25.8	-6.9
125	-30.6	-28.0	-27.6	-9.6
150	-31.3	-28.3	-30.0	-10.3
175	-33.1	-29.4	-30.0	-11.4
$200	-34.4	-32.0	-32.2	-14.0

5.5.1.3.2 Adjacent channel emissions. At a displacement of ±ªf from the terminal's transmit carrier frequency for carrier EIRP levels equal to or greater than +20 dBW, the maximum EIRP values shall not exceed the values specified in Table XXVIII.

5.5.2 5-kHz slave channel modulation requirements.

5.5.2.1 Modulation formats. The modulation for all 5-kHz slave channel transmissions shall be 50% shaped offset quadrature phase-shift keying (SOQPSK). The ideal SOQPSK signal can be represented as

$$s(t) = A\sin[w_o t + \phi(t)]$$

$$= \frac{A}{\sqrt{2}}\, a_i(t)\cos\left(w_o t + \frac{\pi}{4}\right) + \frac{A}{\sqrt{2}}\, a_q\left(t - \frac{T}{2}\right)\sin\left(w_o t + \frac{\pi}{4}\right)$$

where

the steady-state values of $\phi(t) = 0, \pi/2, \pi, \text{ and } 3\pi/2$,

and where

$a_i(t)$ = in-phase data modulation signal, with shaping, as shown by example on Figure 12,

$a_q(t)$ = quadrature data modulation signal, with shaping, as shown by example on Figure 12, and

T = symbol period (reciprocal of the modulation rate).

Below, in a through c, is an explanation of how this SOQPSK signal expression relates to the I and Q channels, I/O data rates, spectral shaping, and Figure 12:

a. By definition, the SOQPSK modulated rf signal contains two transmit data bits per symbol. Therefore, the modulation rate, in sps, is one-half the transmit data rate in bps. The transmit data rate does not necessarily equal the terminal's baseband [input/output (I/O)] data rate. Transmit data bits consist of all user data; extra bits introduced by FEC coding; and all overhead bits introduced by the terminal, including the Preamble and other bits defined in this standard. The transmit data is divided into the two modulation bit sequences $a_i(t)$ and $a_q(t)$. If the sequence of bits to be transmitted consists of bits numbered 1, 2, 3, ... then $a_i(t)$ consists of all odd-numbered bits and $a_q(t)$ all even-numbered bits of the transmit data (the bit sequence for each of the modulation signals, $a_i(t)$ and $a_q(t)$, is every other transmit data bit), as shown on Figure 12. Data buffering is used to accommodate I/O data rate and modulation rate inequalities.

b. In the equation, this representation of the signals, +1 for $a_i(t)$ or $a_q(t)$ corresponds to a bit value of 1, and -1 corresponds to a bit value of 0. At the start of a transmission, while the first bit on the I channel is being transmitted, a bit value of 1 is transmitted on the Q channel during the first quarter of a symbol period. At the end of any transmission, while the last dats bit is being transmitted on either the I or Q

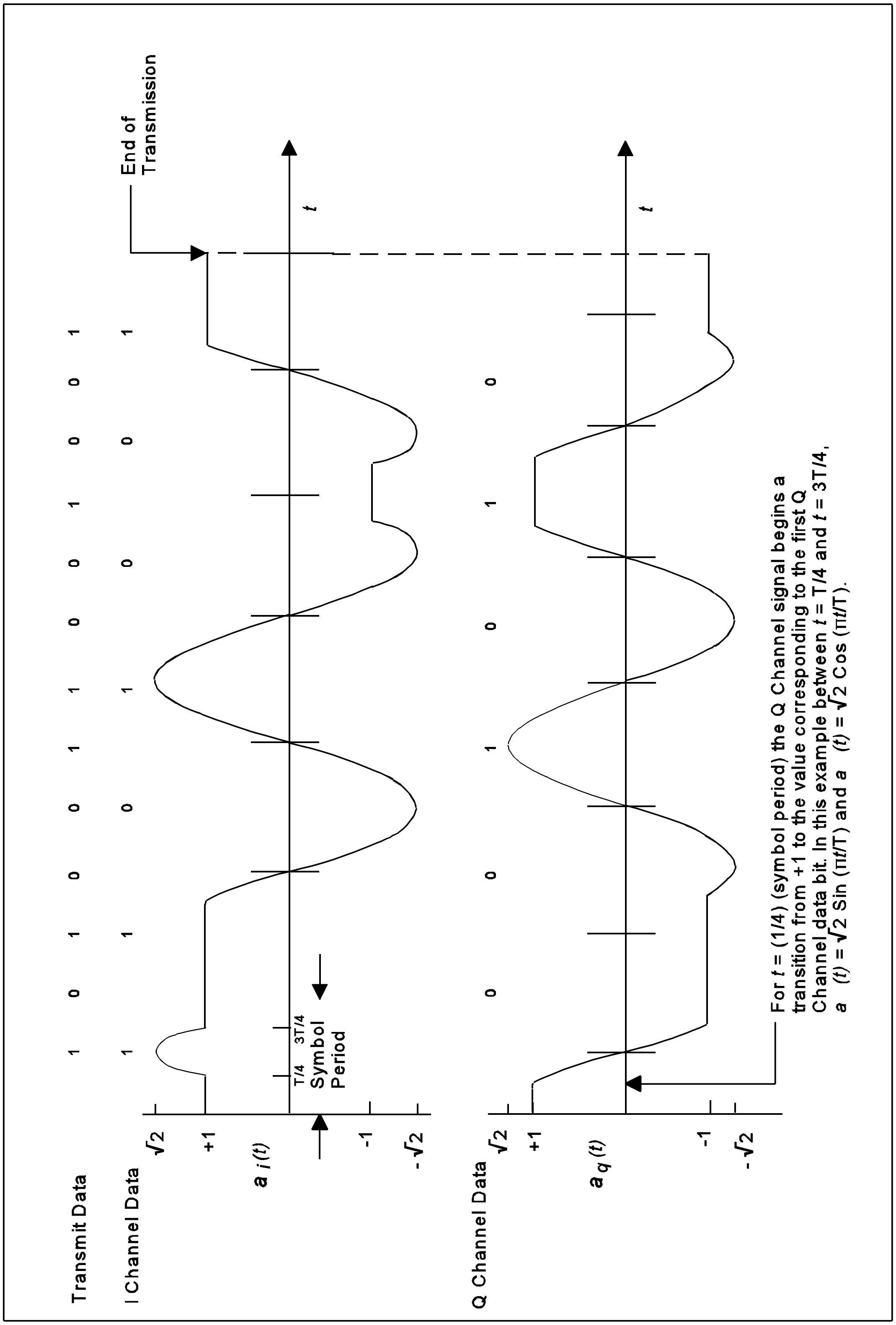


FIGURE 12. Example input to modulator.

channel during the last half-symbol period, the bit level most recently transmitted on the other channel continues to be transmitted with no change.

c. The sinusoidal transitions on $a_i(t)$ and $a_q(t)$ result in a linear rate of change for phase, and a constant-amplitude transmitted signal. Figure 12 shows the Q channel offset (staggered) relative to the I channel by one-half of a symbol. At a time 75 percent through a symbol period, on either the I or Q channel, prior to a change in the modulation data bit, the signal begins a sinusoidal transition toward the value corresponding to the next modulation data bit. The signal reaches the new value at a time 25 percent into the next symbol period.

5.5.2.2 Modulation rates. The modulation rates shall be 3000 and 3840 sps.

5.5.2.3 Adjacent channel emissions. In a nominal 5-kHz bandwidth whose center frequency is displaced by ±Îf from a terminal transmitter's carrier frequency, the EIRP shall not exceed the values specified in Table XXIX.

TABLE XXIX. 5-kHz channel allowable adjacent channel emissions.

)f (kHz)	**RELATIVE EIRP (dB) (CARRIER LEVEL <+18 dBW)**	**MAXIMUM EIRP (dBW) (CARRIER LEVEL$+18 dBW)**
5	-14	+4
10	-34	-16
15	-38	-20
$20	-40	-22

5.5.3 Modulation performance.

5.5.3.1 Bit Error Rate. The terminal shall provide a BER equal to or better than that shown in Table XXX when the C/N_o meets or exceeds the limits for the symbol rates shown in Table XXX. C/N_o is defined as the carrier to noise density, in units of dB-Hz, as measured at the UHF input to the terminal.

5.5.3.2 Burst acquisition probability. Once the orderwire is acquired and the C/N_o is greater than or equal to the reference C/N_o, the terminal shall properly acquire all subsequent bursts with a probability equal to or greater than 0.99 with a confidence level of 90%. When the C/N_o is greater than the reference C/N_o by 1 dB or more, the burst acquisition probability shall be equal to or greater than 0.999 with a confidence level of 90%. The reference C/N_o is defined as the C/N_o needed by the terminal to achieve a BER of 10^{-3} for code rate 1 as defined in Table XXX.

5.5.4 Modulation timing jitter. The root mean square (rms) value of the modulated signal timing jitter shall be less than 2 percent of a transmission symbol period.

TABLE XXX. BER Requirements

BURST RATE sps	CODE RATE	MINIMUM C/N_o	
		BER=10^{-3}	BER=10^{-5}
3000	1/2	40.5	41.9
	3/4	43.3	44.8
	7/8	45.2	46.8
	1	47.1	49.9
3840	1/2	41.5	42.9
	3/4	44.4	45.9
	7/8	46.3	47.8
	1	48.2	51.0
9600	1/2	42.5	43.9
	3/4	45.3	46.8
	1	49.8	52.0
19200	1/2	45.5	46.9
	3/4	48.3	49.8
16000	1/2	49.0	49.5
	3/4	51.3	52.4
	1	54.8	57.6

5.5.5 Modulation rate accuracy. The maximum allowable error in the modulation rate shall be 1 part in 10^6.

5.6 Frequency accuracy. One set of assumptions that can be used to derive the values in 5.6.1 and 5.6.2 is provided in Appendix E.

5.6.1 Uplink frequency accuracy. The uplink frequency of any transmission, as received at the satellite, shall result in a downlink signal at the satellite output that is within 100 Hz of the allocated downlink frequency provided a and b, below, are both true:

a. The CCOW transmission from the satellite is within 30 Hz of the allocated downlink frequency, and

b. The satellite inclination angle is equal to or less than 10 degrees.

5.6.2 Downlink frequency accuracy. The terminal shall be capable of acquiring downlink signals within 310 Hz of the allocated center frequency. The accuracy of the CCOW downlink frequency at the satellite is 30 Hz.

5.7 User communications security (COMSEC).

5.7.1 Voice security. Voice digitization and security shall be as follows:

a. Mandatory. Secure voice at 2400 bps shall be interoperable with the digitization and encryption techniques specified in MIL-C-28883A for the Advanced Narrowband Digital Voice Terminal (ANDVT), application 3.

b. Optional. Secure voice at 4800 bps shall be interoperable with the code-excited linear prediction (CELP) digitization techniques specified in FED-STD-1016 and the encryption techniques specified in NSA-84 for the KG-84A/C.

c. Optional. Secure voice at 16,000 bps shall be interoperable with continuously variable slope delta (CVSD) digitization techniques specified in CSESD-14 and encryption techniques specified in CSESD-14 for the VINSON family of equipment.

5.7.2 Data security. Data encryption shall be interoperable with KYV-5 and KG-84A/C encryption devices. Terminals that embed COMSEC devices shall support all data rates specified in this standard.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Considerations for terminal specification and development. Other than in 5.1.3.5.3.1 and 5.1.3.5.3.2, this standard intentionally does not specify the baseband interface or the timing relationships between (1) incoming baseband data and the outgoing over-the-air data burst or (2) incoming over-the-air data burst and the outgoing baseband data. While potential differences in baseband I/O timing and buffering techniques among terminals developed to this standard can be tolerated by most networks, there are existing networks with specific timing requirements. Some networks have requirements for containing a block of data within a known burst. For example, OTCIXS II networks use the TD-1271B/U multiplexer Slot Time Marker output to synchronize the baseband data to the TDMA frame. Specifications for terminals need to include any network-specific requirements such as the one described above, if applicable. If, for example, a terminal must operate on an OTCIXS II network, the specification for that terminal must require the terminal to emulate the TD-1271B/U baseband interface characteristics.

6.2 Tailoring guidance for contractual application. To ensure proper application of this standard, invitations for bids, requests for proposals, and contractual statements of work should tailor the requirements in sections 4 or 5 of this standard to exclude any unnecessary requirements. For example, if the statement of work requires a revision to a standard, then all the paragraphs related to handbooks, bulletins, and notices should be excluded.

6.3 Request for single access channel. Terminals may request a DASA channel assignment using the RCCOW:Two-Party Request or RCCOW:Conference Request message, based on an operationally coordinated protocol. The CC will assign a DASA channel based on the agreed to protocol. Examples of operationally agreed to protocol is the use of the configuration codes, network addresses, or the use of a two-step process using the RCCOW:Information Report containing an agreed to DASA request code.

6.4 Voice capability.

6.4.1 MIL-C-28883 baseline. At the time of publication of this standard the version of MIL-C-28883 available was MIL-C-28883A with change 2 and engineering change proposal (ECP) up through 060. Future use of this standard should refer to the latest version of this specification.

6.4.2 Mixed Excitation Linear Prediction (MELP). There are efforts underway to improve the quality of voice communications employing MELP techniques. MELP was developed by Texas Instruments under contract to NSA. Interim test results show that performance on a 2400 bps channel employing MELP is equivalent to or better than that on a 4800 bps channel employing CELP techniques. A federal standard is in the process of being developed. Pending completion of the federal standard, information on MELP is documented in NSA Report R22-03-96, "Analog to Digital Conversion of Voice by 2400 bps Mixed Excitation Linear Prediction", with NSA library number S243,638. The NSA report contains the draft version of the federal standard. A DoD Digital Voice Processing Consortium is looking to implementing MELP into communications equipment. Assuming success in completing the federal standard, this voice digitization technique will have application for those terminals operating over UHF SATCOM channels.

6.5 Truth tables. To aid in the understanding of various field combinations, truth tables will be inserted into section 6 as required.

TABLE XXXI. CCOW RCCOW-Assignment truth table.

If the		Then the **User Number** field is set to
CALL ACK field is set to	**RCCOW Assignment** field is set to	
000	00001 to 00101	binary zero and any terminal can transmit in the next frame’s RCCOW time slot.
000	10000	binary zero and no terminal can transmit in the next frame’s RCCOW time slot.
000	a code other than above	a terminal base or I/O port address. The next frame’s RCCOW is assigned to that address.
Non Zero	00001 to 00101, and 10000	the I/O port address for which the CALL ACK applies

6.6 Subject term (key-word) listing. The following key words, phrases, and acronyms apply to MIL-STD-188-183:

demand-assigned multiple access (DAMA)
Fleet Satellite Communications System (FSCS)
satellite communications (SATCOM)
time-division multiple access (TDMA)
ultra high frequency (UHF)
25-kHz UHF SATCOM channels
5-kHz UHF SATCOM channels

6.7 Identification of changes. Marginal notations are not used in this revision, to identify changes made with respect to the September 1992 issue, due to the extent of the changes. Table XXXII lists the major changes made and the paragraphs within MIL-STD-188-183A affected by the changes.

Table XXXII. Major changes made to standard.

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Format/editorial changes to comply with MIL-STD-962C.	Multiple
Moved figures and tables to appendix.	Figures A-1 through A-3 and Tables A-II, A-III and A-VI through A-X.
Assigned numbers to unnumbered tables.	Multiple
Modified text to consistently use base, I/O port, and guard address versus multiple terms now being used.	Multiple
Moved shall statements from table and figure notes and from field descriptions into the document text.	Multiple
Changed the term “KG ID” in the CCOWs to “Scrambled CC KG ID”.	Multiple
Changed the term “Station ID” in the RCCOWs to “Scrambled Terminal KG ID”	Multiple
Added requirement for 5- and 25-kHz slave channels.	3.1, 4.2, 4.2.2-4.2.2.2, 4.4.2, 5.1.1, 5.1.1.1, Figures 2 and 4, 5.1.3.5.2.2, Appendix A
Added mandatory requirement that the channel’s frame format be made known to the terminal operator in the DC mode.	4.4.1

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Deleted requirement for frequency switching in DC mode.	4.4.1, 5.2.2.1, and deleted Figures from Appendix B
AC mode. Added requirement that terminals that are not automatic frequency-switch capable will not be assigned to communicate on a channel other than their own home channel.	4.4.2
Moved Figures 3, 4, and 5 and Tables IV, VI, VII, VIII, IX, and X to a new Appendix A; added corresponding data for 5-kHz slave channel to new Appendix A; renumbering remaining appendices.	5.1 through 5.1.3.5
Clarified ranging requirements and guard time definition.	5.1.3 and 5.1.4
Changed terminal transmission inhibit time from 500 Fsec to 650 ±150 Fsec.	5.1.3 c
Added requirement to allow a burst to begin or end anywhere in a slot on 5-kHz slave channels to reduce TDMA throughput delay.	5.1.3.5.2.2, Figure A-4
Modified 25-kHz TDMA throughput delay and added requirement for 5-kHz throughput delay.	5.1.3.5.3.1 and 5.1.3.5.3.2
Clarified that a terminal can use any 5-kHz time slot that has more guard band than the terminal has range uncertainty. 384 or more time chips was changed to read 367 or more time chips.	5.1.4 a
Added a fifth method for updating burst transmission time.	5.1.4 b 5
Clarified that the initial ranging burst is allowed in any frame, not just the next.	5.1.4.1.1 a
Clarified that a 258 ms range estimate can only be used when in the random range mode.	5.1.4.1.1 b
Changed method 2 ranging for fast moving terminals from a mandatory system requirement to an optional method.	5.1.4.1.2

TABLE XXXII. Major changes made to standard (continued).

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Clarified that only terminals required to perform Method 1 ranging shall locate an unused ELT slot to use for dedicated ranging.	5.1.4.1.2.1
Made it mandatory that when the ranging attempt fails, the terminal has to repeat its attempt to locate an available ELT slot.	5.1.4.1.2.1 a and 5.1.4.1.2.2 a
Made it mandatory that when no range transmission was attempted in an ELT slot or when two consecutive ranging attempts failed, that the terminal cease transmission in subsequent ELT slots.	5.1.4.1.2.1 b and 5.1.4.1.2.2 b
Clarified that only terminals required to perform Method 2 ranging shall range once in an ELT slot and again in the even range slot 512 frames later.	5.1.4.1.2.2
Moved the six common CCOW fields into one paragraph with renumbering of CCOW message paragraphs.	5.2.1.1.1 through 5.2.1.1.2.20
Clarified requirements for special frame format changes.	5.2.1.1.2.1 b and 5.2.1.1.2.7
Added new CCOW:No Command to be used when there is no other CCOW message to be sent by the CC. AC and DC mode.	5.2.1.1.2.2, Figure B-2, Table IX, 5.2.2.1.2.2, Table X
Since the user #ID is not always used, the User ID #1, User #1 All Ports Flag, User #2 All Ports Flag, and Time #1 fields were changed to cover this contingency.	5.2.1.1.2.3
Deleted Time Offset field of the CCOW:Slot Connect message and expanded Frequency Code length to 8 bits. All orderwires that specify frequency code now use the same table to determine uplink and downlink frequencies.	5.2.1.1.2.4 and Figure B-4 (Byte 13)
Clarified terminal requirement when CCOW:Slot Connect message received and terminal port is connected.	5.2.1.1.2.4

TABLE XXXII. Major changes made to standard (continued).

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Clarified how a terminal is to use the Bit Rate and Slot Number fields in the CCOW:Slot Connect message.	5.2.1.1.2.4 a and b
Modified Dedicated Range Frame-Number field of the CCOW:Link Test and Range Frame Number Assignment message to reflect change in ranging epoch times.	5.2.1.1.2.5 f, Figure B-5 (Byte 12, bits 0-3)
Deleted definitions of unique fields for CCOW:Channel Control Handover Request and RCCOW:Acknowledge Channel Control Request messages.	5.2.1.1.2.6, 5.2.1.2.2.11, Figures B-6 and C-13
Changed name of CCOW:Channel Reassignment message to CCOW:TDMA Channel Reassignment	5.2.1.1.2.9.1, Figure B-9, throughout standard
Clarifies that when the acquisition of a new home channel fails, that the terminal transmit an RCCOW:Status Report B message for I/O Port #1.	5.2.1.1.2.9.1
Added a Satellite Change Flag to the CCOW:TDMA Channel Reassignment message to note if the new home channel is on a different satellite.	5.2.1.1.2.9.1 c, Figure B-9 (Byte 7, bit 6)
Changed name of CCOW:Timed Channel Assignment message to CCOW:DASA Channel Assignment.	5.2.1.1.2.9.2, B.2, Figure B-10, throughout standard
Added to the description of the CCOW:DASA Channel Assignment message to specify that the terminal is to disconnect all existing connections and retain all queued RCCOWs when the terminal is assigned to a DASA channel.	5.2.1.1.2.9.2
Added a Satellite Change Flag to CCOW:DASA Channel Assignment message to note if the new home channel is on a different satellite.	5.2.1.1.2.9.2 c, Figure B-10 (Byte 7, bit 6)
Added Configuration Code field to CCOW:DASA Channel Assignment message to include, but not limited to, data rate to be used on DASA channel.	5.2.1.1.2.9.2 f, Figure B-10 (Byte 13)

TABLE XXXII. Major changes made to standard (continued).

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Changed configuration code and port configuration code fields from BCD to HEX. Valid configuration code range is now 1-FF instead of 1-99, yielding 255 possible configuration codes.	5.2.1.1.2.9.2 g, Figure B-10; 5.2.1.2.2.1 b, Figure C-1; 5.2.1.2.2.7 e, Figure C-8; and 5.2.1.2.2.8.1 h, Figure C-9
Added requirement that a terminal shall not allow local or CCOW entry of duplicate guard addresses into the terminal.	5.2.1.1.2.10
Add requirement that terminal I/O ports connected to a slot assigned to a deleted guard address shall disconnect from the slot. This prevents a terminal from operating in a service assigned to a deleted guard address.	5.2.1.1.2.11
Added new CCOW:Satellite Ephemeris Data for transmitting satellite ephemeris data for terminals to determine range without need for transmissions.	5.2.1.1.2.20, Figures B-21A, 21B, and 21C
Added RCCOW:Conference Party List as an RCCOW that is transmitted in response to an RCCOW assignment code sent by the CC in the RCCOW Assignment field of a CCOW message.	5.2.1.2, Table XVII
Moved Initial Entry Flag and Stored Call fields to common field paragraph and deleted these fields from all RCCOW message descriptions with renumbering of RCCOW message paragraphs.	5.2.1.2.1 through 5.2.1.2.2.13
Specified that a terminal is not to send a CCOW:Status Report B message automatically except to report that a configuration code has changed to a new value or when returning from a failed TDMA channel reassignment.	5.2.1.2.2.1
Added Slot Disconnect flag to allow a user to request the channel controller to terminate a DAMA communications service.	5.2.1.2.2.4 b, Figure C-5 (Byte 3, bit 5)

TABLE XXXII. Major changes made to standard (continued).

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Added Time-Slot Number field to identify the time slot from which the terminal(s) are disconnected.	5.2.1.2.2.4 c, Figure C-5 (Byte 6, bits 0-4)
Added Channel Frequency Code field to identify the channel frequency code where the service was completed.	5.2.1.1.2.4 d. Figure C-5 (Byte 7, bits 0-7)
Clarified requirement for terminal not to automatically reconnect its I/O ports when transmit control reenabled.	5.2.1.1.2.19
Deleted requirement for terminals to maintain 14-bit addressing capability, except for RCCOW:Data Transfer message.	5.2.1.1.1 c, 5.2.1.2.2.2.2
Cleared up the meaning of Out-of-Service. It is the baseband equipment connected to the reporting I/O port, not the terminal I/O port.	5.2.1.2.2.5
Clarified that a terminal is not to disconnect from user time slots when it sends an RCCOW:Out of Service message.	5.2.1.2.2.5
Added requirement for the terminal to report the DC Circuit Number associated with the time slot in which a constant key condition exists.	5.2.1.2.2.6 c and Figure C-7 (Bytes 8 and 9)
Added requirement to resend a copy of the original request when the Cancel Call Flag is set to binary 1.	5.2.1.2.2.7 and 5.2.1.2.2.8.1
CCOW:Two-Party Request. Added requirement to estimate the time the communications circuit will be needed.	5.2.1.2.2.7 g, Figure C-8 (Byte 10)
Modified RCCOW:Link Test Results message to add reporting of C/N_o, changed the reporting of symbol errors to an optional field based on the terminal's specification, deleted reporting of symbol erasures, and renamed the RCCOW to RCCOW:C/N_o and Link Test Results	5.2.1.2.2.9, Figure C-11 (Byte 6, bits 0-6; byte 7; byte 8, bit 8; and byte 9)

TABLE XXXII. Major changes made to standard (concluded).

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Corrected the name of the field used to report the length of a Link test and changed it from bits tested to frames tested.	5.2.1.2.2.9 f, Figure C-11 (Byte 11)
Clarified that terminal with 4 or fewer ports or which is unable to respond with the solicited RCCOW, responds to a Status Report A Group 2 RCCOW assignment with a Status Report A Group 1 response.	5.2.1.2.2.10 and 5.2.1.2.3.2.1
Added Terminal Version field to RCCOW:Status Report A to allow terminals to report what version of MIL-STD-188-183 the terminal was capable of supporting.	5.2.1.2.2.10 e, Figure C-12 (Byte 10, bits 5-7)
Added a 5-kHz Capable Flag to the RCCOW:Status Report A, allowing the terminal to indicate its capability to be reassigned to a 5-kHz DAMA channel.	5.2.1.2.2.10 j, Figure C-12 (Byte 11, bit 3)
Changed the RCCOW:Acknowledge Channel Control Request message data fields that are defined in the CC system specifications to “See MIL-STD-188-185" bits.	5.2.1.2.2.11, Figure C-13 (Byte 6, bits 0-2), bytes 7 through 11)
Reduced the number of bits in the Port Guarding fields of the RCCOW:Guard List Report from 4 bits to 3 bits to be consistent with max number of I/O ports per terminal (8).	5.2.1.2.2.12 a, b, and c; Figure C-14 (Byte 4, bits 0-3; byte 5, bits 0-8)
Modified RCCOW transmission protocol and added positive acknowledgment of receipt of RCCOW.	5.2.1.2.3 through 5.2.1.2.3.5, 5.2.2.3 through 5.2.2.3.5
Rewrote entire Orderwire Processing section to simplify the processing flow.	5.3
Added requirement for FEC code rates 3/4 and 7/8 using punctured coding.	5.4.1, Appendix A
Added detailed definition of modulation employed for 25-kHz channels.	5.5.1
Added 5-kHz slave channel modulation requirements.	5.5.2

TABLE XXXII. Major changes made to standard (concluded).

CHANGE	PARAGRAPHS, FIGURES TABLES AFFECTED
Added adjacent channel emissions requirements.	5.5.1.3, Table XXVIII; 5.5.2.3, Table XXIX
Added preamble structure for user SOQPSK 3.0 and 3.84 KSPS	Figure 5
Changed the CCOW:Channel Control Handover Request bytes 4, 7 (bits 6 & 7), and 9 through 13 to reserved bytes/bits.	Figure B-6
Clarified that throughput delay did not include COMSEC equipment contributions.	Tables VII and VIII
Added definitions for AC mode ACK field codes.	Table X
Updated KG parameter change flag table	Table XV
Deleted RCCOW:Conference Request (or Cancel Call)(Type B) optional and RCCOW:Guard List Report (Type B) optional, changed RCCOW:Acknowledge Channel Control Request and RCCOW:Data Transfer (Type A) to optional RCCOWs, renamed RCCOW:Conference Request (or Cancel Call)(Type A) to RCCOW:Conference Request (or Cancel Call) and RCCOW:Guard List Report (Type A) to RCCOW:Guard List Report.	Table XVI
Deleted DC CCOW #1, DC CCOW #2, and DC CCOW #3.	Table XX
Assigned channel frequency codes 240 through 249	Table D-I

APPENDIX A

TIME SLOT DEFINITION

A.1 SCOPE

This appendix is a mandatory part of this standard. The information contained herein is intended for compliance. All transmissions within the 5- and 25-kHz TDMA frame are required to occur within the time slots defined herein.

A.2 CONTENTS

This appendix defines the various user communications bursts for 5- and 25-kHz channels.

! Section 1 defines the 25-kHz TDMA A, B, and C user segment subformats. For each of the user segments, the baseband I/O rate, burst rate, code rate, AC slot number, and DC circuit number are defined for each frame subformat time slot. The same information is provided for 5-kHz channels, except for DC circuit number, and information is added on guard time and total time slot size.

! Section 2 defines the burst duration, in time chips, for each user communications burst. Burst duration is defined for each available I/O data, code, and modulation rate combination.

! Section 3 defines the burst start and stop times in time chips for each of the 25-kHz user communications burst options defined in Section 2. In addition, the DC circuit number and allocated guard time is identified for each communications burst.

The figure and table names defining 5- and 25-kHz timing requirements are as follows:

SECTION 1: USER SEGMENT FRAME SUBFORMAT TIME SLOTS

PAGE
25-kHz segment A time slots 132
25-kHz segment B time slots 133
25-kHz segment C time slots 134
5-kHz slave channel user time slots 135

SECTION 2: BURST DURATION DERIVATION

Orderwire and system support burst duration 138
User communications burst duration for FEC code rate 1/2 . . 139
User communications burst duration for FEC code rate 3/4 . . 140
User communications burst duration for FEC code rate 7/8 . . 140
User communications burst duration for FEC code rate 1 . . . 141

SECTION 3: USER SEGMENT BURST START AND STOP TIME IN TIME CHIPS

25-kHz segment A time slot times 143
25-kHz segment B time slot times--format 1 145

25-kHz segment B time slot times--format 2 146
25-kHz segment C time slot times--format 1 148
25-kHz segment C time slot times--format 2 150

APPENDIX A

SECTION 1

USER SEGMENT FRAME SUBFORMAT TIME SLOTS

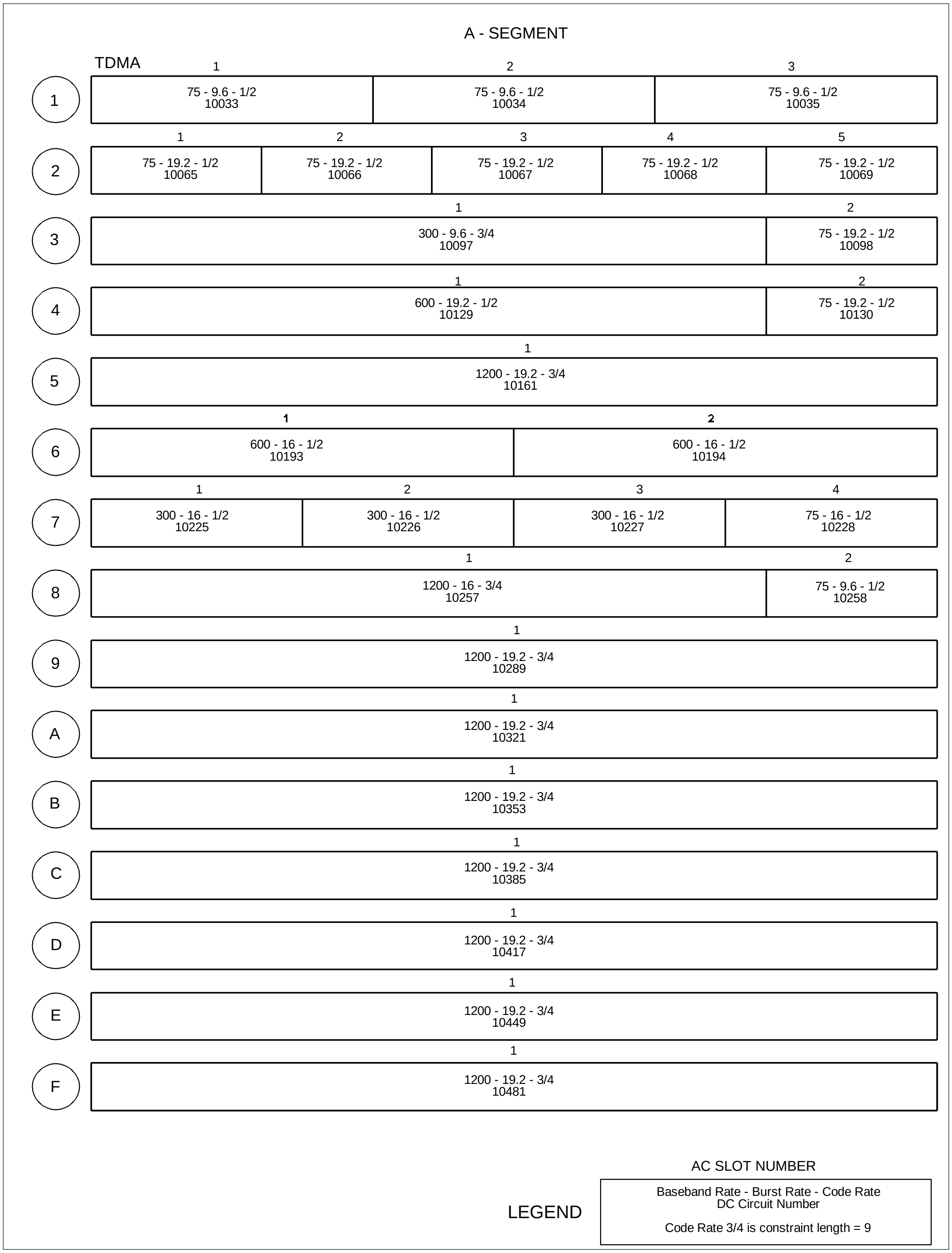


FIGURE A-1. 25-kHz segment A time slots.

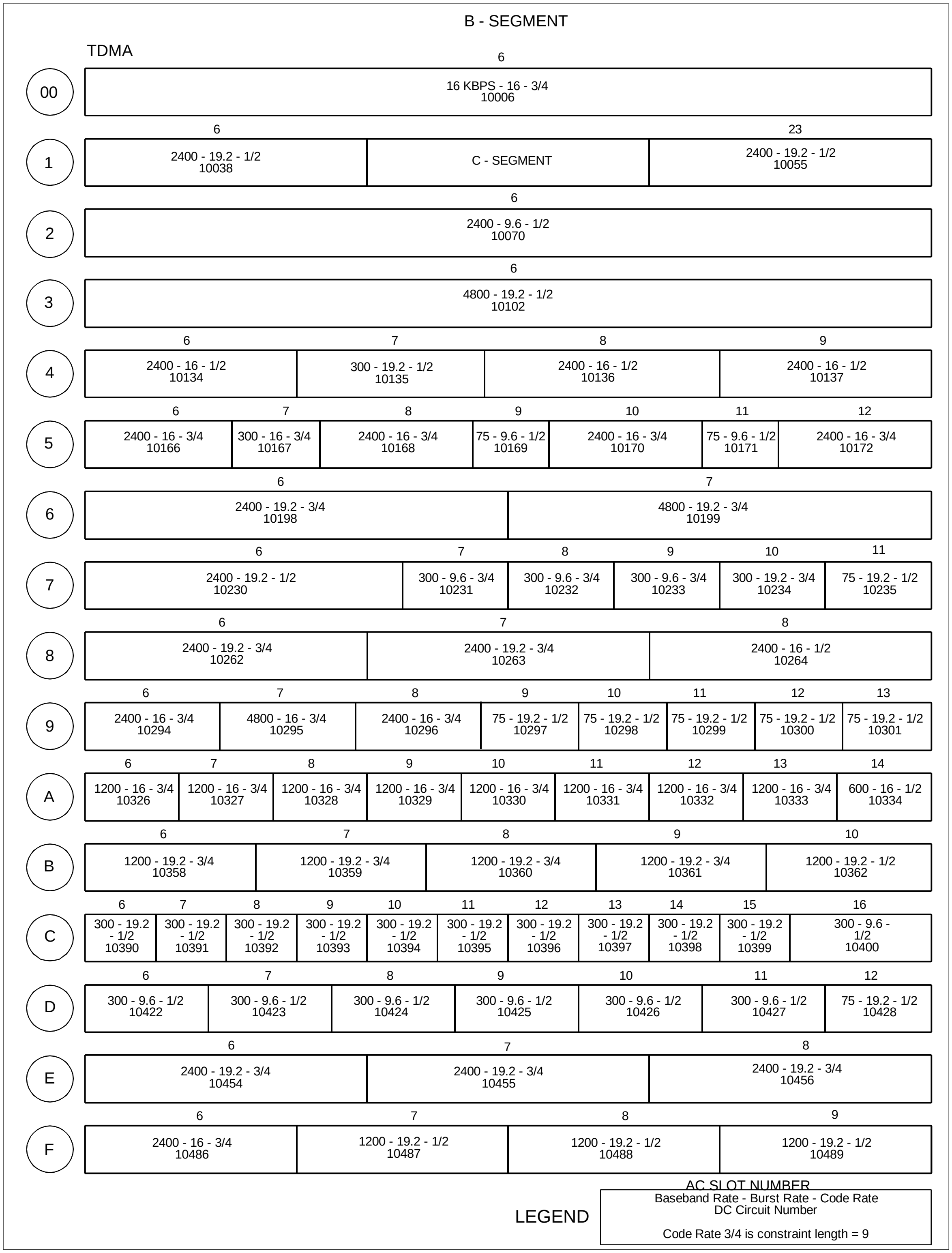


FIGURE A-2. 25-kHz segment B time slots.

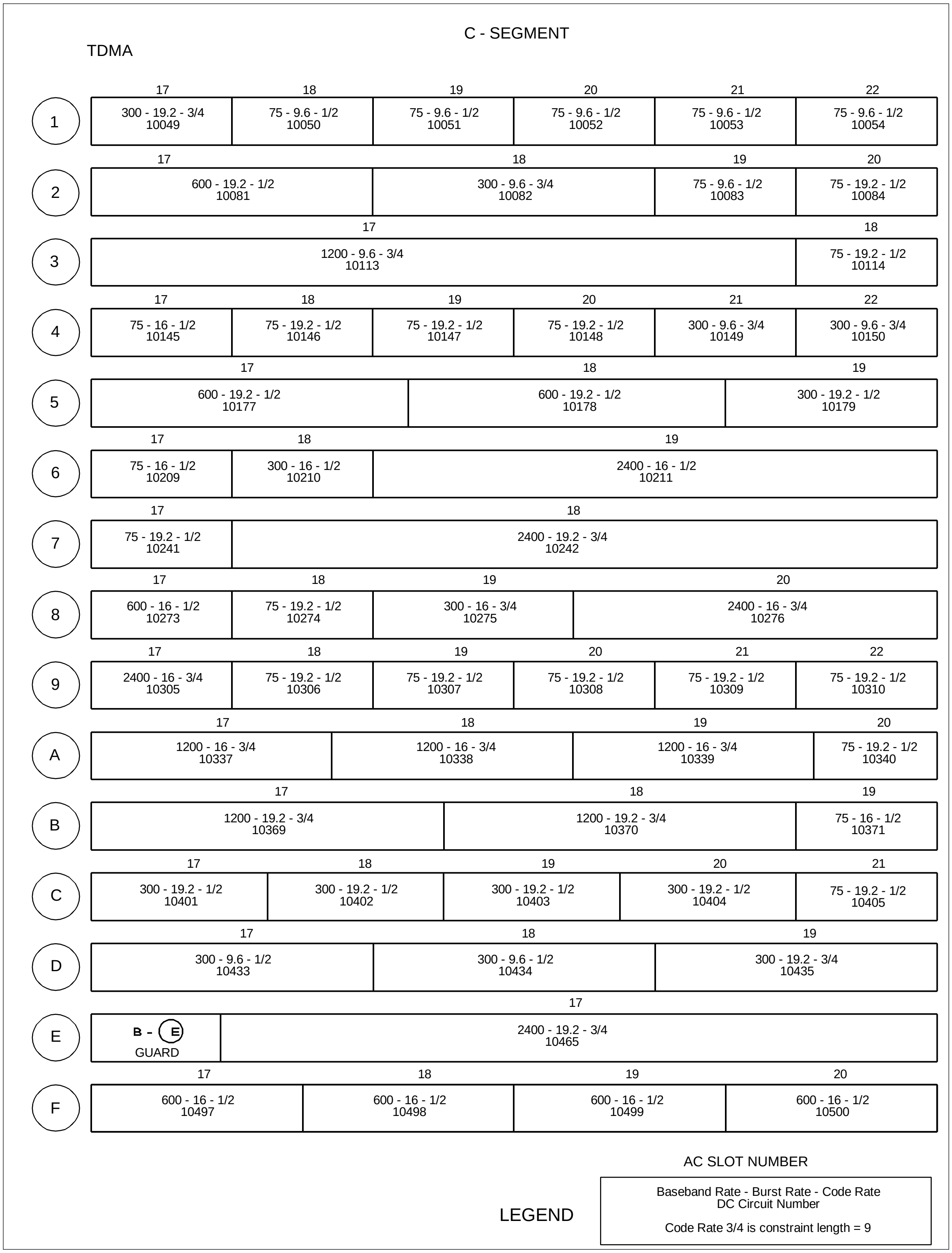


FIGURE A-3. 25-kHz segment C time slots.

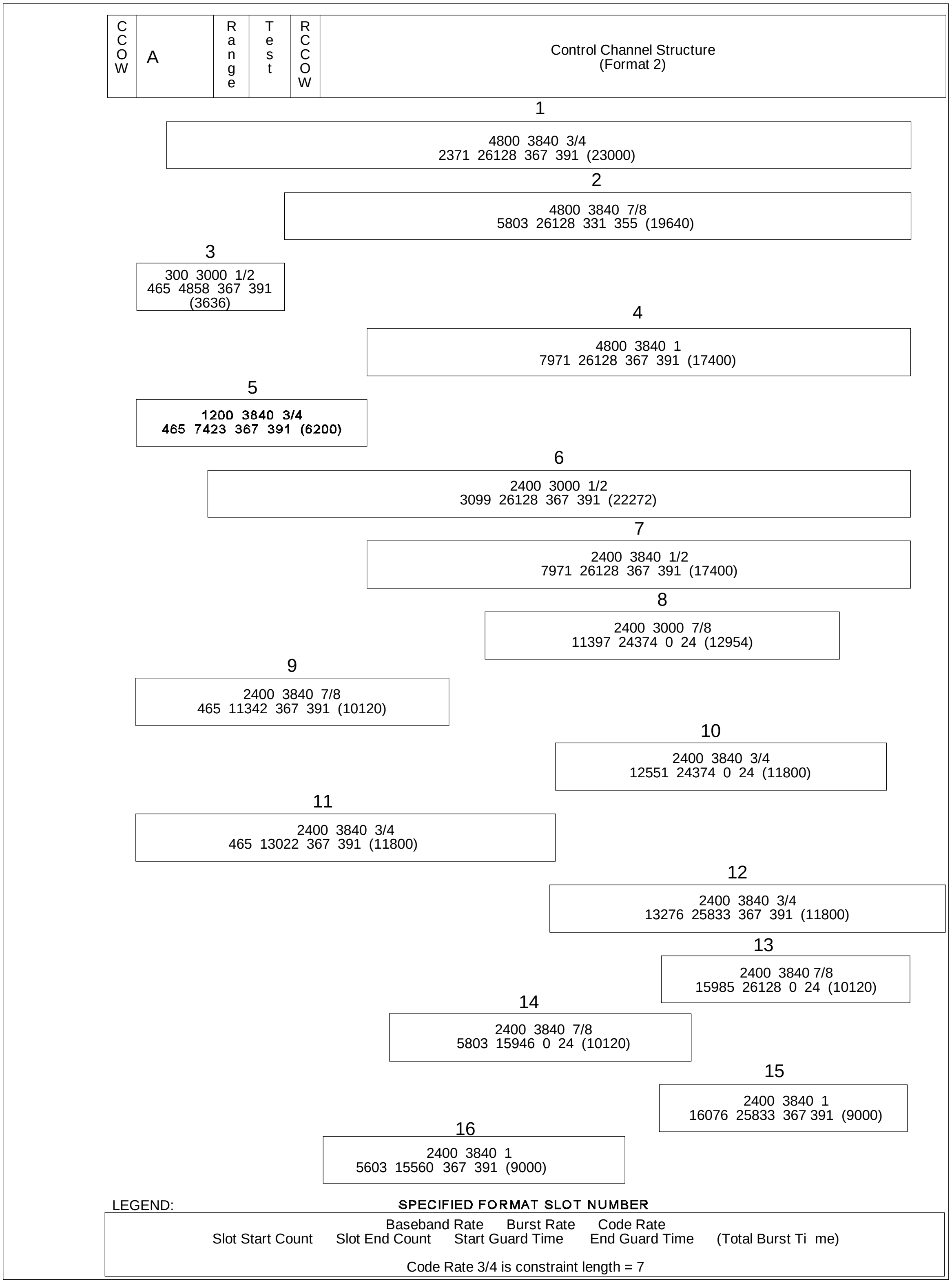
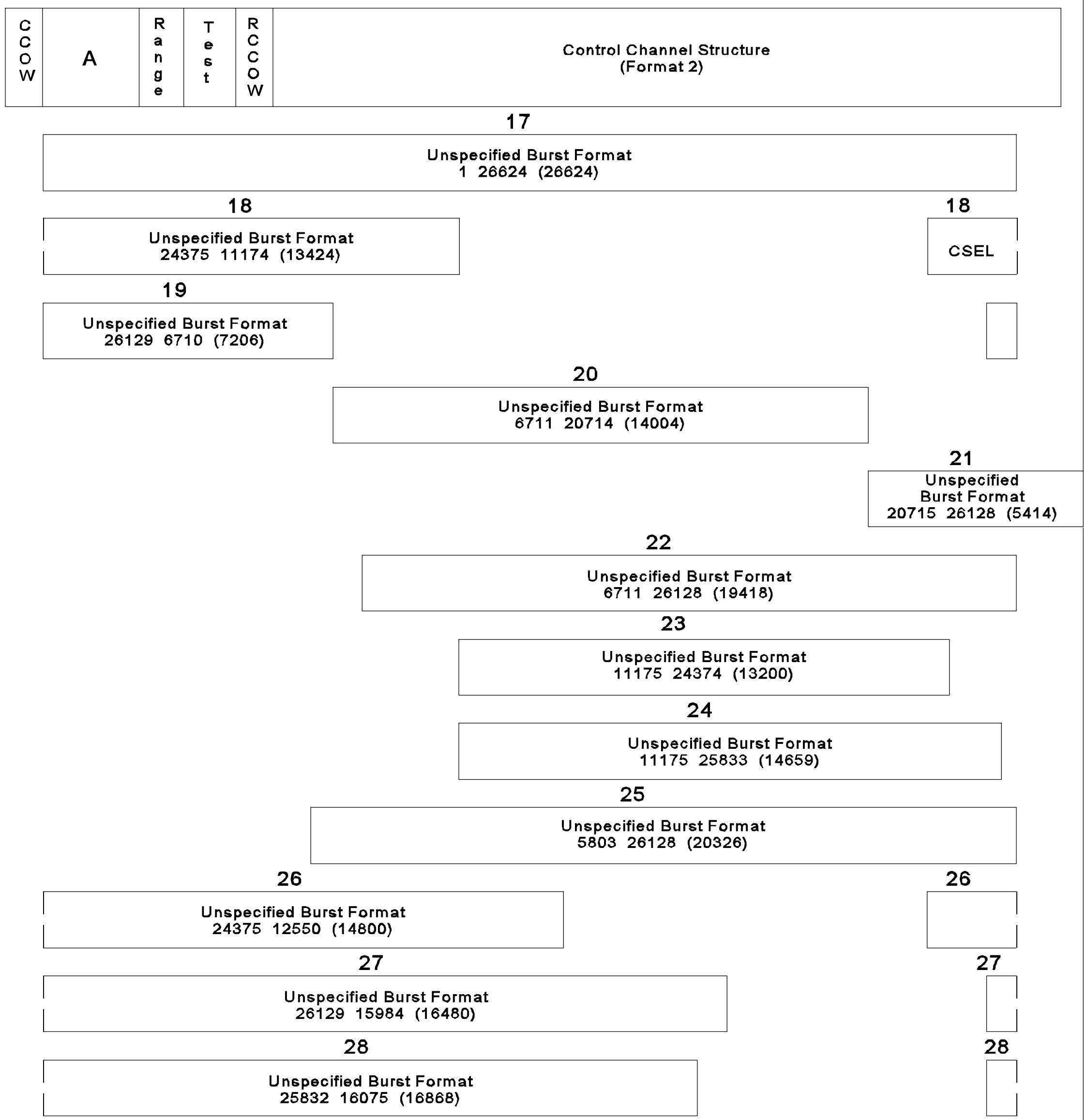


FIGURE A-4. 5-kHz slave channel user time slots.



The purpose of the *Unspecified Burst Format* time slots is to allow:

1. DAMA terminals and terminals compliant with other TDMA frame compatible waveforms (i.e. CSEL) to share a single 5-kHz channel without interfering with each other.
2. Implementation and use of modulation and error correction types and rates that are not defined at the time of publication of the standard.
3. A higher (link) layer to automatically control the modulation and error correction rates defined in the standard.

LEGEND:

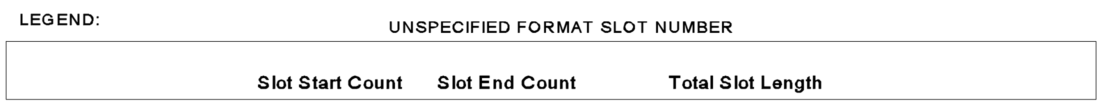


FIGURE A-4. 5-kHz slave channel user time slots. (concluded)

SECTION 2

BURST DURATION DERIVATION

TABLE A-I. Orderwire and system support burst duration.

SLOT TYPE	BURST RATE (ksps)	INFORMATION BITS (NUMBER OF BITS)			TRANSMITTED SYMBOLS* (NUMBER OF SYMBOLS)			BURST DURATION (TIME CHIPS)
		DATA	FILL***	TOTAL	INFORMATION	PREAMBLE	TOTAL	
CCOW	9.6	104	8	112	224	248	472	944
RCCOW	9.6	104	8	112	224	198	422	844
RANGE & ELT SLOT	9.6	80	0	80	80	248	328	656
LINK TEST SLOTS** (ODD NUMBERED FRAME)	9.6	72	0	72	72	198	270	540
	19.2	296	0	296	296	252	548	548
	16.0	592	0	592	296	162	458	550

NOTES:

* CCOW and RCCOW bursts employ k = 7, rate 1/2 coding; range and link test bursts employ code rate 1.

** The quantity of odd-numbered frames to perform a 9.6-ksps link test is 139 (10,008 bits divided by 72 total information bits per frame). Similarly, for a 19.2-ksps link test, 34 odd-numbered frames are required (10,064 bits divided by 296 total information bits per frame). For a 16.0-ksps link test, 17 odd-numbered frames are required (10,064 bits divided by 592 total information bits per frame).

*** These interleaver fill bits are set to binary 0.

TABLE A-II. User communications burst duration for FEC code rate 1/2.

FEC *k* = 7, Code Rate = 1/2								
DATA I/O RATE (bps)	**BURST RATE (ksps)**	**INFORMATION BITS (NUMBER OF BITS)**			**TRANSMITTED SYMBOLS (NUMBER OF SYMBOLS)**			**BURST DURATION (TIME CHIPS)**
		DATA	**FILL ***	**TOTAL**	**INFORMATION**	**PREAMBLE**	**TOTAL**	
75	9.6	104	8	112	224	198	422	844
	19.2	104	8	112	224	252	476	476
	16.0	104	8	112	112	162	274	328.8
300	3.0	416	32	448	448	120	568	3635.2
	9.6	416	32	448	896	198	1094	2188
	19.2	416	32	448	896	252	1148	1148
	16.0	416	32	448	448	162	610	732
600	19.2	832	64	896	1792	252	2044	2044
	16.0	832	64	896	896	162	1058	1269.6
1200	19.2	1664	16	1680	3360	252	3612	3612
2400	3.0	3328	32	3360	3360	120	3480	22272
	3.84	3328	32	3360	3360	120	3480	17400
	9.6	3328	32	3360	6720	198	6918	13836
	19.2	3328	32	3360	6720	252	6972	6972
	16.0	3328	32	3360	3360	162	3522	4226.4
4800	19.2	6656	64	6720	13440	252	13692	13692

NOTE: * These interleaver fill bits are set to binary 0.

APPENDIX A

TABLE A-III. User communications burst duration for FEC code rate 3/4.

FEC *k* = 7 or 9 (See note below), Code Rate = 3/4								
DATA I/O RATE (bps)	BURST RATE (ksps)	INFORMATION BITS (NUMBER OF BITS)			TRANSMITTED SYMBOLS (NUMBER OF SYMBOLS)			BURST DURATION (TIME CHIPS)
		DATA	FILL *	TOTAL	INFORMATION	PREAMBLE	TOTAL	
300	9.6 **	416	88	504	672	198	870	1740
	19.2 **	416	88	504	672	252	924	924
	16.0 **	416	88	504	336	162	498	597.6
1200	3.84	1664	16	1680	1120	120	1240	6200
	9.6 **	1664	16	1680	2240	198	2438	4876
	19.2 **	1664	16	1680	2240	252	2492	2492
	16.0 **	1664	16	1680	1120	162	1282	1538.4
2400	3.84	3328	32	3360	2240	120	2360	11800
	19.2 **	3328	32	3360	4480	252	4732	4732
	16.0 **	3328	32	3360	2240	162	2402	2882.4
4800	3.84	6656	64	6720	4480	120	4600	23000
	19.2 **	6656	64	6720	8960	252	9212	9212
	16.0 **	6656	64	6720	4480	162	4642	5570.4
16000	16.0 **	22184	160	22344	14896	162	15058	18069.6

NOTES:
- * These interleaver fill bits are set to binary 0.
- ** Constraint length k = 9 encoders on 25-kHz channels.

TABLE A-IV. User communications burst duration for FEC code rate 7/8.

FEC k = 7, Code Rate 7/8								
DATA I/O RATE (bps)	BURST RATE (ksps)	INFORMATION BITS (NUMBER OF BITS)			TRANSMITTED SYMBOLS (NUMBER OF SYMBOLS)			BURST DURATION (TIME CHIPS)
		DATA	FILL *	TOTAL	INFORMATION	PREAMBLE	TOTAL	
2400	3.0	3328	4	3332	1904	120	2024	12953.6
	3.84	3328	4	3332	1904	120	2024	10120
4800	3.84	6656	8	6664	3808	120	3928	19640

NOTE:
- * These interleaver fill bits are set to binary 0.

APPENDIX A

TABLE A-V. User communications burst duration for FEC code rate 1.

CODE RATE 1								
DATA I/O RATE (bps)	BURST RATE (ksps)	INFORMATION BITS (NUMBER OF BITS)			TRANSMITTED SYMBOLS (NUMBER OF SYMBOLS)			BURST DURATION (TIME CHIPS)
		DATA	FILL *	TOTAL	INFORMATION	PREAMBLE	TOTAL	
2400	3.84	3328	32	3360	1680	120	1800	9000
4800	3.84	6656	64	6720	3360	120	3480	17400

NOTE:
* These interleaver fill bits are set to binary zeros.

SECTION 3

USER SEGMENT BURST START AND STOP TIME IN TIME CHIPS

TABLE A-VI. 25-kHz segment A time slot times.

SUBFORMAT NUMBER	TIME SLOTS 1	2	3	4	5
1	10033 465 1338 30	10034 1339 2213 31	10035 2214 3088 31		
2	10065 465 988 48	10066 989 1513 49	10067 1514 2038 49	10068 2039 2563 49	10069 2564 3088 49
3	10097 465 2408 204	10098 2409 3088 204			
4	10129 465 2560 52	10130 2561 3088 52			
5	10161 465 3088 132				
6	10193 465 1776 42	10194 1777 3088 42			
7	10225 465 1220 24	10226 1221 1977 25	10227 1978 2734 25	10228 2735 3088 25	
8	10257 465 2123 120	10258 2124 3088 121			
9	10289 465 3088 132				

LEGEND:

The numbers in each slot (box) correspond to the following parameters:

1. DC circuit number
2. Start receive time count (time-chip number)
3. End slot time count (time-chip number)
4. Guard time (number of time chips)

TABLE A-VI. 25-kHz segment A time slot times (concluded).

SUBFORMAT NUMBER	TIME SLOTS 1	2	3	4	5
A	10321 465 3088 132				
B	10353 465 3088 132				
C	10385 465 3088 132				
D	10417 465 3088 132				
E	10449 465 3088 132				
F	10481 465 3088 132				

LEGEND:

The numbers in each slot (box) correspond to the following parameters:

1. DC circuit number
2. Start receive time count (time-chip number)
3. End slot time count (time-chip number)
4. Guard time (number of time chips)

TABLE A-VII. 25-kHz segment B time slot times--format 1.

USER SEGMENT B-1 (A) 6	USER SEGMENT C		USER SEGMENT B-1 (B) 23
10038 5836 12838 31	C-Segment	RCCOW	10055 19126 26128 31

LEGEND:

The numbers in each slot (box) correspond to the following parameters:

1. DC circuit number
2. Start receive time count (time-chip number)
3. End slot time count (time-chip number)
4. Guard time (number of time chips)

NOTE:

This is the configuration #1 subformat of segment B. It is used only when format 1 is selected.

TABLE A-VIII. 25-kHz segment B time slot times--format 2.

SUBFORMAT NUMBER	TIME SLOTS 6	7	8	9	10	11	12	13	14	15	16
00	10006 *7384 26128 675										
2	10070 6711 20714 168										
3	10102 6711 20714 312										
4	10134 6711 10980 43	10135 10981 12172 44	10136 12173 16443 44	10137 16444 20714 44							
5	10166 6711 9619 26	10167 9620 10243 26	10168 10244 13153 27	10169 13154 14024 27	10170 14025 16934 27	10171 16935 17805 27	10172 17806 20714 26				
6	10198 6711 11472 30	10199 11473 20714 30									
7	10230 6711 13750 68	10231 13751 15558 68	10232 15559 17367 69	10233 17368 19176 69	10234 19177 20169 69	10235 20170 20714 69					
8	10262 6711 11546 104	10263 11547 16382 104	10264 16383 20714 105								
9	10294 6711 9629 36	10295 9630 15236 36	10296 15237 18155 36	10297 18156 18667 36	10298 18668 19179 36	10299 19180 19691 36	10300 19692 20203 36	10301 20204 20714 35			
A	10326 6711 8296 47	10327 8297 9882 47	10328 9883 11468 47	10329 11469 13054 47	10330 13055 14640 47	10331 14641 16226 47	10332 16227 17811 47	10333 17812 19398 47	10334 19399 20714 46		
B	10358 6711 9287 85	10359 9288 11864 85	10360 11865 14441 85	10361 14442 17018 85	10362 17019 20714 84						
C	10390 6711 7889 31	10391 7890 9068 31	10392 9069 10247 31	10393 10248 11426 31	10394 11427 12605 31	10395 12606 13784 31	10396 13785 14962 30	10397 14963 16140 30	10398 16141 17318 30	10399 17319 18496 30	10400 18497 20714 30

SUBFORMAT NUMBER	**TIME SLOTS**									
	6	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
D	10422 6711 8955 57	10423 8956 11200 57	10424 11201 13445 57	10425 13446 15690 57	10426 15691 17935 57	10427 17936 20180 57	10428 20181 20714 58				
E	10454 6711 11546 103	10455 11547 16403 124	10456 16404 21293 157								
F	10486 6711 9665 72	10487 9666 13348 71	10488 13349 17031 71	10489 17032 20714 71							

NOTES:

1. * Chip numbers 6711 through 7383 (inclusive) are guard times at the beginning of this slot.
2. The B-1 subformat is shown in Table A-VII.
3. The numbers in each slot correspond to the following parameters: (1) DC circuit number, (2) start receive time count (time chip number), (3) end slot count (time chip number), and (4) guard time (number of time chips).

TABLE A-IX. 25-kHz segment C time slot times--format 1.

SUBFORMAT NUMBER	TIME SLOTS 17	18	19	20	21	22
1	10049 12839 13807 45	10050 13808 14696 45	10051 14697 15585 45	10052 15586 16474 45	10053 16475 17363 45	10054 17364 18252 45
2	10081 12839 14959 77	10082 14960 16776 77	10083 16777 17698 78	10084 17699 18252 78		
3	10113 12839 17745 31	10114 17746 18252 31				
4	10145 12839 13196 29	10146 13197 13701 29	10147 13702 14206 29	10148 14207 14712 30	10149 14713 16482 30	10150 16483 18252 30
5	10177 12839 14941 59	10178 14942 17044 59	10179 17045 18252 60			
6	10209 12839 13209 42	10210 13210 13983 42	10211 13984 18252 42			
7	10241 12839 13417 103	10242 13418 18252 103				
8	10273 12839 14154 46	10274 14155 14677 47	10275 14678 15322 47	10276 15323 18252 47		
9	10305 12839 15746 25	10306 15747 16247 25	10307 16248 16748 25	10308 16749 17249 25	10309 17250 17750 25	10310 17751 18252 26

LEGEND:

The numbers in each slot (box) correspond to the following parameters:

1. DC circuit number
2. Start receive time count (time-chip number)
3. End slot time count (time-chip number)
4. Guard time (number of time chips)

TABLE A-IX. 25-kHz segment C time slot times--format 1. (concluded).

SUBFORMAT NUMBER	TIME SLOTS 17	18	19	20	21	22
A	10337 12839 14457 80	10338 14458 16076 80	10339 16077 17695 80	10340 17696 18252 81		
B	10369 12839 15363 33	10370 15364 17889 34	10371 17890 18252 34			
C	10401 12839 14055 69	10402 14056 15272 69	10403 15273 16489 69	10404 16490 17706 69	10405 17707 18252 70	
D	10433 12839 15064 38	10434 15065 17290 38	10435 17291 18252 38			
E	10465 13418 18252 103					
F	10497 12839 14191 83	10498 14192 15544 83	10499 15545 16898 84	10500 16899 18252 84		

LEGEND:

The numbers in each slot (box) correspond to the following parameters:

1. DC circuit number
2. Start receive time count (time-chip number)
3. End slot time count (time-chip number)
4. Guard time (number of time chips)

APPENDIX A

TABLE A-X. 25-kHz segment C time slot times--format 2.

SUBFORMAT NUMBER	TIME SLOTS 17	18	19	20	21	22
1	10049 20715 21683 45	10050 21684 22572 45	10051 22573 23461 45	10052 23462 24350 45	10053 24351 25239 45	10054 25240 26128 45
2	10081 20715 22835 77	10082 22836 24652 77	10083 24653 25574 78	10084 25575 26128 78		
3	10113 20715 25621 31	10114 25622 26128 31				
4	10145 20715 21072 29	10146 21073 21577 29	10147 21578 22082 29	10148 22083 22588 30	10149 22589 24358 30	10150 24359 26128 30
5	10177 20715 22817 59	10178 22818 24920 59	10179 24921 26128 60			
6	10209 20715 21085 42	10210 21086 21859 42	10211 21860 26128 42			
7	10241 20715 21293 103	10242 21294 26128 103				
8	10273 20715 22030 46	10274 22031 22553 47	10275 22554 23198 47	10276 23199 26128 47		
9	10305 20715 23622 25	10306 23623 24122 24	10307 24123 24624 26	10308 24625 25125 25	10309 25126 25626 25	10310 25627 26128 26

LEGEND:

The numbers in each slot (box) correspond to the following parameters:

1. DC circuit number
2. Start receive time count (time-chip number)
3. End slot time count (time-chip number)
4. Guard time (number of time chips)

TABLE A-X. 25-kHz Segment C time slot times--format 2 (concluded).

SUBFORMAT NUMBER	TIME SLOTS 17	18	19	20	21	22
A	10337 20715 22333 80	10338 22334 23952 80	10339 23953 25571 80	10340 25572 26128 81		
B	10369 20715 23239 33	10370 23240 25765 34	10371 25766 26128 34			
C	10401 20715 21931 69	10402 21932 23148 69	10403 23149 24365 69	10404 24366 25582 69	10405 25583 26128 70	
D	10433 20715 22940 38	10434 22941 25166 38	10435 25167 26128 38			
E	10465 21294 26128 103					
F	10497 20715 22066 82	10498 22067 23420 84	10499 23421 24774 84	10500 24775 26128 84		

LEGEND:

The numbers in each slot (box) correspond to the following parameters:

1. DC circuit number
2. Start receive time count (time-chip number)
3. End slot time count (time-chip number)
4. Guard time (number of time chips)

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